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MANURING COCOA.

The results of the Cocoa manuring experiments at Peradeniya brought up to March 1914 have just been issued as a Bulletin (No. 14) of the Department of Agriculture. The experiments have been in progress since 1906 but we must await the results of several years yet before any final conclusions can be drawn. The Bulletin contains, however, some interesting figures well worth the study of planters.

Manures were applied annually from 1906 to 1911 and then discontinued. Looking first at the results of these years we find the Ammonium sulphate plot heading the list among the 22 under trial. The deduction is first that in these experiments nitrogen proved the dominant manure for Cocoa and that when the applications were yearly this was best applied as Sulphate of Ammonia, a quick-acting manure. After the application of manure ceased Sulphate of ammonia gave way to Castor cake and Blood meal. The latter for some reasons not clear did very badly for the first six years.

Next to the nitrogenous plots the most successful was Potassium sulphate. It maintained a good position (5th and 4th) in the years following the cessation of manures. Phosphoric acid occupied a lower place than Potash taking the period through, though in 1912-13 it rose rapidly to second place. In the manured years the quick-acting Concentrated superphosphate kept ahead of Bone dust but the positions have now begun to be reversed. Groundnut cake proved disappointing. During the

years 1906-12 it was ninth. It rose to third place the following year but dropped to 13th last year. Fish was high up during the manuring years; was first in 1912-13 and then fell away badly. But for yearly, or even alternate-year, manuring Fish is obviously worth a place in mixtures. Nitrate of soda did indifferently. The most striking fact brought out by these experiments is the decline in crop as the effects of the manures became exhausted. The average for all the plots during 1906-12 was 4·7 cwt. per acre; in 1913-14, three years after the last application of manures, the average yield dropped to 3 cwt. In the Ammonia, Potassium sulphate, Concentrated superphosphate, Castor cake and Fish plots the corresponding figures are 5·4 cwt. and 3·6 cwt.

The plots, as we have stated, were manured till 1911. 1912-13 was the first year allowed to pass without manure. The mean yields of the 22 plots for this year show a slight increase over those of the average for the previous 7 years—5 cwt. as against 4·7. This suggests that with yearly applications the unexhausted value of the manures when accumulated for several years has as much effect upon a particular crop as the manures applied that year and it illustrates the advantage of keeping land in good heart. It should not, however, be inferred that alternate manuring is as good as yearly. Under such a system the unexhausted value in any given year would be only half of that under a system of yearly manuring.

The plots show great variations in their relative positions so, as has been stated, no final conclusions are yet permissible as to what manure or mixtures are most suitable for Cocoa under conditions corresponding to those of Peradeniya. At the same time the results will serve as a guide. There can be no doubt, however, about the lesson they teach as to the advantages of manuring generally speaking. Each planter can work out for himself the profit an additional $1\frac{3}{4}$ cwt. of cocoa per acre would return him on the outlay on the manure. With normal prices it should amount to cent. per cent.

R. N. L.

RUBBER.

AN IDEAL RUBBER ESTATE FACTORY.

LEONARD SMITH.

Great care must be taken in choosing the site of a rubber estate factory. A central position, a good water supply, and a suitable road leading from the factory to the main roads are important factors in the choosing of a factory site.

FACTORY.

Corrugated iron buildings are the best and cheapest for use in the tropics, but they are liable to become very hot, and should be painted outside with a cooling composition. A jack roof at the ridge of the building will give a free current of air, and skylights let into each bay of the roof should be partitioned off from the factory, thus making a separate room. Shallow glazed tile tanks should also be built on the verandah for the reception of tree scraps, bark shavings, etc. The floors of the factory, coagulating shed and verandahs must be made of concrete with a thick top dressing of cement.

MACHINES.

There are quite a number of efficient machines on the market for the preparation of plantation rubber, and the whole battery should be of one type, thus dispensing with the necessity of keeping a large stock of spare parts for different makes of the machines. Seven machines are required to deal with a crop of 500,000 lb., and should consist of two smooth roller machines, one marking roller machine for the finishing of sheet rubber, and one scrap washer, which should be fixed outside the factory on the verandah. The rollers should be made of deep chilled cast iron. The foundations of the machines should be raised about 9 inches above the floor of the factory, and the top laid with glazed tiles. Drains should be made around the foundations for carrying off the water used during the washing process, and screens put at each outlet to prevent any small pieces of rubber being washed away into the main drain. A light girder should be fixed over the machines, about 8 feet high, so that a pair of chain pulley blocks on runners can be used for the changing of the rollers when necessary.

MOTIVE POWER.

Gas or oil engines can be installed, but if the gas engines are used the generators should be placed outside the factory.

Two engines of 65 B.H.P. of the same type should be installed, one of which would act as a stand by in the event of a break-down.

By keeping a complete set of spare parts any loss from delay would be reduced to a minimum.

HOT AIR DRIER.

A hot air drier should be included in the plant. This does away with the large drying-rooms which are necessary if crepe rubber is air-dried. Crepe rubber dried by the hot air process is ready for packing in five or six days from the time the latex is brought into the factory. A drier after the style of the Colombo Commercial Company is easily worked, and the advantage over the vacuum drier is that each chamber being a separate unit, the rubber in any one chamber can be examined during the drying process without interfering with the working of the other chambers. With a drier of six chambers the various grades of rubber of a day's crop are dry by the next day.

DRYING ROOM.

An iron building 60 ft. by 40 ft. running north and south will be sufficient for drying purposes, provided the crepe rubber is dried by a heating apparatus. It should be a lofty, single-storey building, having plenty of ventilation. The slats over which the crepe is hung should not be fixed less than 6 inches apart, so as to allow a good circulation of air between the strips of rubber.

Louvre windows should be fitted, which not only give excellent light and ventilation, but also exclude the sun's rays from directly striking the rubber and causing tackiness.

The floor should be made of concrete, with a top dressing of cement.

SMOKE HOUSE.

The smoke house should be a two-storey building, 135 feet long and 30 feet wide. It should be divided into three separate rooms, 45 feet by 30 feet, each having its own entrance. This allows of one room, irrespective of the others, being filled with sheet, smoking being continued day and night, and an even temperature maintained till the rubber is ready for packing. On the other hand, if the smoke house is a continuous building, it has to be opened daily to hang up each day's rubber, thus causing a fall of temperature. The openings in the floor should be covered with a fine mesh wire gauze, to prevent dust getting into the upper room where the rubber is hung. Three shallow furnaces should be provided for each room, and baffle plates fixed about two feet above each furnace, to prevent sparks rising. Four racks 26 feet long, 4 feet wide, and 8 feet high, running the length of the building should be erected in each room. This will leave a passage of about 2 feet round each rack, and each room will accommodate from 10,000 to 12,000 lb. of sheet rubber.

PACKING ROOM.

The packing room should be a separate building, 40 feet by 30 feet, built close to the smoke house and drying room. The floor should be made of concrete, with a thick top dressing of cement.

LIGHT RAILWAY.

A narrow-gauge light railway, running from the verandah through the factory, and continued to the drying and packing rooms is a great labour-saver for the handling of the rubber after manufacture.

MANUFACTURE OF PLANTATION RUBBER.

Smoked Sheets.—A uniform quality is the main object to be attained, which can only be acquired by bulking the whole of the day's latex on its arrival at the factory. The factory is equipped for the manufacture of 500,000 lb. per annum, and of this 70 per cent., or 350,000 lb., should be made into sheet rubber. Assuming 300 working days in the year, it will be seen that the daily output of sheet will be about 1,170 lb. For the bulking of the latex a shallow glazed tile tank must be built. Taking on an average that 1 gallon of latex contains $1\frac{1}{2}$ lb. of dry rubber, a tank with a capacity of 780 gallons is required. The size of the tank will be 40 feet long, 6 feet 3 inches wide, and 6 inches deep. By weighing the latex on arrival at the factory, the quantity received from various fields can be ascertained.

No tapping coolies should be allowed into the factory or the coagulating room, as they bring in a lot of dirt, especially after the wet weather. The latex should be received on the open verandah by one of the coagulating room coolies, and poured into the tank by a fine mesh strainer. It may happen that some time elapses between the first and the last lot of latex arriving at the factory, and natural coagulation may set in, but this is easily overcome by the use of an anti-coagulant, such as formalin or sodium sulphite, neither of which chemicals interfere in any way with the quality of the finished rubber. After the whole of the latex has been strained into the tank, it must be thoroughly mixed by means of broad paddles, and afterwards skimmed ready for coagulation. The tank is now divided into 13 sections, each containing 60 gallons. Acetic acid is the coagulant generally used, and should be made up into a stock solution of one part of acid to 25 parts of water, 1 gallon of this solution used to every section of 60 gallons. The acetic acid must be well stirred into the latex with broad paddles, skimmings taken off, and partitions fixed about 2 inches apart, so as to form long narrow strips of coagulum. Coagulation should be allowed to take place over night. Next morning the strips of coagulum can be cut up into lengths of about 12 inches, and rolled out into sheets. The sheets should be rolled through the smooth rollers to a thickness of $\frac{3}{16}$ inch to $\frac{1}{4}$ inch, put through the marking rollers, and then hung on racks in the factory to allow all the surface water to drain off, previous to being hung in the smoke house. Old timber from the clearings, etc., with a few coconut husks are good enough to supply the smoke for curing the sheets. Smoking must be continued at an even temperature of not more than 120 degrees. Maximum and minimum thermometers should be used in the smoke house, and examined night and morning, thus keeping a check on the cooly in charge of the smoking operations. Sheets rolled as above are thoroughly dry and smoke cured in 23 to 25 days.

CREPES.

Lump Crepe Rubber.—Coolies' buckets on arrival at the factory contain a certain amount of naturally coagulated latex known as lump, from which the latex should be well squeezed. This lump should be put through the macerator rollers without delay, as oxidation setting in causes streaky strips in the finished rubber. Crepe made from naturally coagulated lump is greatly improved in appearance if soaked for one night in a 2 per cent. solution of sodium bi-sulphite.

Tree Scrap, Bark Scrap, and Earth Rubber Crepes.—All the above rubber is treated practically in the same manner. It should not be left lying about in heaps, but should be washed in the scrap washer and made up into crepe as soon as possible. If it is found impossible to finish all the grades the same day, the tree scrap can be left soaking in water in one of the glazed tile tanks on the verandah, and worked off next morning.

Drying of Crepe with "Hot Air Drier."—The drying of the various grades of crepe rubber should only take from 1½ to 2 hours, provided the strips have been rolled thin. Care must be taken as to the temperatures at which they are dried. Lump crepe should be dried at 150 degrees, tree scrap and bark scrap at 140 degrees, and earth rubber at 130 degrees. The earth rubber should be closely watched, as it is likely to get very tacky if dried at too high a temperature. The crepe as it comes from the drier is slightly sticky, but if allowed to cool and re-rolled into blanket crepe, to a thickness of ¼ inch, all signs of stickiness disappear. It should now be hung in the drying room, to allow the surface water to drain off, and is ready for packing in about four days.

Packing and Weighing.—The inside of the packing chests should be planed smooth to prevent splinters getting into the rubber. It is best to finish packing one grade at a time, thus preventing mistakes in marking. The chests should be secured with hoop iron, and the grade, net weight and gross weights stencilled on the lid.

GENERAL.

All latex should be made into smoked sheet and not into first latex crepe, as there is a distinct loss of at least 2½ per cent. in making crepe. This is due to the amount of re-rolling necessary in the manufacture of crepe, and certain substances are washed away during the process. It has been stated that the above-mentioned method of making sheet is not practicable, as it is impossible to coagulate latex in such a large quantity, but the writer has had an 800 gallon tank in use for the past 2½ years with great success.—THE INDIA RUBBER JOURNAL.

A MANUFACTURER ON THE PLANTATION RUBBER SITUATION.

At the annual meeting of the Rubber Share and Finance Trust, MR E. L. I. BLYTH, in seconding the adoption of the report, made some statements in connection with plantation rubber that will be of interest. He prefaced his remarks by saying that possibly he could give shareholders a little information on the rubber industry from the manufacturer's point of view which might be interesting. It was a fact that at the present time scientific manufacturers could use plantation rubber for 90 per cent. of their output, and there was no reason why, in a short time—with further experiment, and possibly as the result of changes in the actual latex, which might occur when they got rubber from older trees, such as was the case with the rubber they received from South America—they should not supersede it to the extent of 90 per cent. Certainly, the plantations had not helped the manufacturers much in the direction of using plantation rubber. Manufacturers were compelled to take an immense amount of trouble in the form of testing before

they could use plantation rubber. Never did they get two batches of rubber, even from the same plantation, which could be used without the most scientific testing, both practical and chemical. In the case of hard fine Para they could use 1,000 tons, gathered from anywhere so long as it was "hard fine," without changing their methods; but for each batch of plantation rubber they had to carry out tests at great expense and at considerable waste of time and loss of material. If the plantations would only agree to some recognised system of preparing their rubber, all that difficulty would disappear. There was not the slightest doubt that the small manufacturers were frightened to use plantation rubber, because they had not the scientific staff, both practical and technical, needed to deal with the commodity. They were obliged to confine themselves to "hard fine," because they knew the results, under a certain procedure, were always the same. South American rubber, whether it was old or new, gave the same result. The Chairman had told them that rubber could be stored. That was a fact. They could keep rubber, but they could not keep plantation rubber. They could keep fine hard Para as long as they liked, but they could not keep plantation rubber, because it went mouldy, and was affected in various ways. Much of that arose from the methods of curing, but the fact remained that at the present time they could use plantation rubber for manufacturers to the extent of 90 per cent., and there was no reason why, in a short time, they should not be able to supplant South American rubber. It lay very much with the plantation companies themselves.—India Rubber Journal.

THE TAPPING INTERVAL.

N. C. S. BOSANQUET.

This subject has been so often discussed, and the experiments made in connection with it have differed so largely that I feel the results of experiments over rather more than a year may be of interest. Personally, I have no hesitation in saying that the alternate day system of tapping gives the best results in every way :—

1. As regards yield.
2. As regards cost price.
3. Economizing bark removal.
4. Lessening the number of tappers required.

In making experiments planters are apt to overlook the fact that a few months' alteration in a tapping system does not constitute a fair experiment, and I have constantly heard the remark, "Oh, we tried the alternate-day for three months, but the results were so appalling that we knocked it off." Obviously they would be appalling for the first few months, the trees having been made accustomed to every-day tapping take some time before yielding to the alternate day, but at the same time an increase in the yield per tree per tapping is an almost immediate result of alternate tapping. On one estate the best yield per tree on daily tapping was 4·21 grams, the second month of alternate-day tapping showed 5·77 grams, while in the corresponding month of the following year the yield per tree was 7·60 grams. That is to say in January, 1913, 3,992 lb. were produced at a cost of 1,357 guilders on every day tapping, the following January showed 6,045 lb. costing 1,069 guilders. The above "costs" represent in each case tapping and manufacture

only, and the yields and costs per pound work out as follows :—

1. Every-day tapping.—3,992 lb. at 34 cents per lb. from 16,142 trees = at the rate of 2·33 lb. per tree per annum.

2. Alternate day.—6,045 lb. at 17·7 cents per lb. from 25,448 trees = 2·84 lb. per tree per annum.

3. Alternate day.—8,892 lb. at 12·4 cents per lb. from 27,481 trees= 3·87 lb. per tree per annum.

It must further be noticed that in the alternate-day tapping new and younger trees to the number of 9,306, and then a further 2,033 are included in the figures shown. As regards costs, there can, I think, be no question as to the cheaper method—alternate-day tapping can be calculated to rather more than halve the cost of tapping, while less assistants are needed on the estate, and a considerable saving is made in tools. On an estate in full bearing the decrease in the cost of line room required, and consequent upkeep of lines is also considerable.

With regard to bark saving. On an experiment carried out over one year, the bark on alternate-day tapping lasted just about five months longer than on every day. The contention that the bark dries back on the cut in consequence of a longer tapping interval is certainly true, and alternate-day does not show half the bark used as against every-day tapping, but in every case I have found an enormous saving in bark removal,

Finally, as regards labour an estate of 1,000 acres with coolies tapping 300 trees and planted 100 trees per acre will require 330 tappers, and in these days of labour difficulties, the reduction of 165 tappers is more than worthy of attention. I am encouraged to touch on the tapping interval, as I think I am correct in saying that daily tapping is practically universal in Java, while I know that many properties in the Straits still practise it. The following yield and cost price figures as a comparison between the two systems may be of interest :—

	Tappers.	Crop.	Yield per tree grams.	Cost per lb. cents.	Rainfall, m.m.	Rain days.	Trees tapped per day.	Total trees tapped for the month.	System.
October ...	1,243	1,841	2·32	29	338	11	11,903	357,090	Every day tapping.
November...	1,064	2,275	3·00	20	338	17	11,375	340,270	
December...	1,000	1,676	3·03	19	332	16	8,297	248,910	Showing the last 3 months of one year's tapping on every day system.
January ...	590	1,608	4·54	13	384	18	5,312	159,380	
February ...	373	1,342	4·75	14	478	20	4,237	127,130	
March ...	650	1,594	3·95	13	375	18	6,053	181,590	
April ...	566	1,625	4·78	13	340	12	5,099	152,981	Alternate day tapping in January.
May ...	619	2,212	6·50	12	331	11	5,105	153,154	
June ...	602	2,515	6·75	11	214	7	5,588	167,660	

In February there were 11 days with no tapping owing to rain, and in December and March 10 days in each month. The results show that in the sixth month of the alternate-day tapping a larger crop was secured than in the best month of the every-day tapping. June and December the yield per tree more than doubled, and the cost per pound nearly halved. Taking months with an equivalent rainfall, October and May both had 11 days' rain with 338 and 331 mm. respectively ; the results are practically the same as in June and December. The above figures are taken from a 94 acre clearing of seven-year-old rubber.—INDIA RUBBER JOURNAL.

SOME NOTES ON THE DIFFERENCE IN COSTS ON ITEMS OF RUBBER ESTATE EXPENDITURE IN THE F.M.S. AND CEYLON.

H. K. RUTHERFORD.

I find on nine estates in the F.M.S., comprising 13,464 cultivated acres, the labour force consists of 68 per cent. men, 21 per cent. women, and 11 per cent. children, and that the number of labourers of all these classes is one to every 2·13 acres in cultivation.

In Ceylon on eight estates, comprising 6,496 cultivated acres, the labour force is made up of 57 per cent. men, 34 per cent. women, and 9 per cent. children, and there is one labourer to 1·50 acres. The higher percentage of women in Ceylon arises probably from the fact that women, being so largely employed on the tea estates, remain on these properties when converted into rubber estates, and also that the Tamil coolies in the F.M.S. do not make that country their permanent home as they do in Ceylon, but return to their families in India after a few years' work.

It will be seen that while in Ceylon it requires one cooly for 1·50 acres, in the F.M.S. the ratio is 1 to 2·13 acres. This is accounted for by the fact that while in the F.M.S. manurial operations are carried out to a very limited extent and confined to liming the ground, intensive manuring is a necessity in Ceylon, and it requires a greater labour force accordingly per acre.

EUROPEAN SUPERVISION.

Estates generally speaking are much larger in the F.M.S. than in Ceylon. Of the estates for which I have figures the average cultivated acreage of the former is 1,500 acres, as against 580 acres in Ceylon. In the former there is one European to 348 acres, while in the latter one to 385 acres. This does not show so much difference as one would expect. The estates in the F.M.S. are generally very flat, and more easily traversed than those in Ceylon, which are broken up and hilly, and therefore the latter might naturally on that account require more supervision when to the work is added the manurial operations, for which, of course, supervision is necessary. The yield of rubber, however, is heavier on F.M.S. estates, and this again should entail more supervision. It has also to be taken into consideration that on every estate in the F.M.S. there are always one or two

assistants on leave, and these are taken into account in the above calculations, which reduces the acreage supervised per man. On balance, however, it would appear that the two countries are about equal in the European staff required to work the estates. Complaints are often made of the expensive nature of European supervision in the F.M.S. as compared with Ceylon. I find that when fees to visiting agents and salaries and allowances to superintendent and assistants are taken together, the result is that the cost in the F.M.S. is 2*s.* 6*d.* per cultivated acre per annum in excess of Ceylon. When the higher cost of living, and the feverish character of the country is taken into consideration, this increase does not seem unreasonable.

MEDICAL CHARGES.

In this item of expenditure, we see at once that the F.M.S. is at a distinct disadvantage as regards the health of its labour force as compared with Ceylon, for it costs 7*s.* per acre per annum to provide for medical wants of the coolies, against 5*s.* 6*d.* per acre in Ceylon, and this latter includes an export tax for medical aid. Doubtless in time when the remedial measures now being taken in hand to prevent malaria are perfected, the cost will be considerably reduced.

RECRUITING OF LABOUR.

As is well known, the systems adopted in the two countries for supplying estates with labour are entirely different. In Ceylon this is effected by advancing the Canganies (headmen) monies to supply the labour force required, such advances being recoverable from the coolies' earnings. As matters stand at present in Ceylon, the average indebtedness of the cooly may be taken at Rs. 70. If we assume that only Rs. 20 of that amount will ever be recovered there is a loss of Rs. 50 per head, which spread over five years, or at one cooly to 1½ acres, equals Rs. 6·66 per acre per annum. In the F.M.S. the Government controls the immigration of labour, and charges the estates their proportion of costs, but in addition the estate pays for sending headmen to India and for quarantine and other outlays. These charges, on the estates whose figures I have, amount to Rs. 5·60 per cultivated acre per annum, say 13*s.* against Ceylon's 8*s.* 10*d.* In very many instances Ceylon's annual outlay would not amount to anything approaching 8*s.* 10*d.* per acre, as coolies remain much longer than five years.

WEEDING.

In Ceylon this averages 13*s.* 3*d.* per acre per annum, and in the F.M.S. it is 14*s.* 9*d.*

REMOVING PESTS AND DISEASES.

While in Ceylon the cost is only 1*s.* 4*d.* per acre; on the other hand, owing to fomes and white ants the cost of this item averages 4*s.* per acre in the F.M.S.

UPKEEP OF ROADS AND DRAINS.

There is practically little difference in this item, the cost in both cases being about 3*s.* 3*d.* per acre per annum.

Quit Rent varies in the F.M.S. from 6*s.* to 9*s.* per acre per annum according to the terms on which the land was acquired from Government. In Ceylon the lands are freehold, and the interest on the purchase price would range from 6*d.* to 1*s.* per acre.

DRAINAGE AND WATER SUPPLY SCHEMES.

In some districts in the F.M.S. these works have been carried out by Government, and an annual assessment made on the estates benefited by these measures. In Ceylon, on the other hand, nowhere are drainage works required, and as a rule estates are naturally well supplied with water, and any works necessary are carried out at the sole expense of the estate.

Sundry Expenses such as stationery, fire insurances, cattle, and contingencies are common to both in the matter of expenditure, and need not here be compared.

I find that salaries, allowances, medical, recruiting and contingencies which are classed as a rule under the head of "general charges" in the F.M.S., amount to 64*s.* 6*d.* per acre, as compared with 47*s.* 6*d.* in Ceylon, and that in the matter of cultivation, which includes weeding, upkeep of roads and drains, diseases and pests, tools and sundry items, the cost equals 23*s.* per acre in the F.M.S. and 20*s.* in Ceylon, but if we add to this the cost of manuring at the rate of 9*s.* per acre in the F.M.S. and 35*s* in Ceylon, we have the relative costs of cultivation brought to 55*s* per acre for Ceylon, as compared with 32*s.* in the F.M.S.

In the F.M.S. the export tax on rubber, when at 2*s.* per lb., and at a yield of 300 lb. per acre, is equivalent to a tax of 15*s.* per acre. In Ceylon the export tax in a like yield would amount to 3*s.* per acre, but this has been already included under the head of "medical charges" mentioned above.

I do not intend here to deal with the cost of harvesting, curing, and shipping the rubber, but may do so at some other time, and then show the total cost per lb. of producing the rubber in both countries delivered in London.—India Rubber Journal.

SYNTHETIC RUBBER.

The remarks of Sir William Crooks a short while ago in his presidential address, delivered before the Society of Chemical Industry, show that this eminent authority recognises the value of the scientific work done in this line. Dr. Crooks said in part: "Recent work on the synthesis of rubber has attracted much attention and notable advances have been made. As long ago as 1882 Tilden noticed that isoprene was converted into rubber by certain chemical reagents; ten years later he showed that this product was capable of vulcanization. Subsequent work led to the recognition of the fact that most substances containing a conjugated double linkage tend to polymerize, the polymers ranging from stick substances through well-defined rubbers to hard resins. Polymerization may be spontaneous or it may be brought about by reagents, acids or alkalies, by heat or by sunlight."

In 1908, C. Harries and F. W. Matthews simultaneously discovered that metallic sodium is an excellent reagent for the polymerization of isoprene. The action is practically quantitative and not affected by impurities. Moreover, it takes place in the cold or by only moderate heating.

Professor Harries showed that a superior product could be obtained by the polymerization of butadiene. Research showed that isoamyl-alcohol obtained from fusel oil was a most suitable material to work on. By means

of dry hydrochloric acid gas it was converted into chloride, then chlorinated to give the double chloride, from which the hydrochloride acid was eliminated by passing over hot soda lime. The isoprene so formed was then sealed up with 3 per cent. thin sodium wire and heated for several days to 60 degrees. The dark brown product thus formed was treated with acetone to precipitate the rubber. To obtain the fusel oil Fernbach has worked out a new process of fermentation starting with starch.

Holt has recently made some valuable discoveries relating to the manufacture of isoprene from the pentanes found in petroleum oil, and the preparation of butadiene from benzine or phenol, tetra hydro-benzine being formed as an intermediate product. He has also observed that when isoprene is treated with sodium in an atmosphere of carbonic acid gas it gives quite different products from those obtained by the same action in air. Recent work shows that all synthetic caoutchoucs differ chemically from the natural rubber. Physically they are only equal to medium grade natural rubbers.—India Rubber World.

COFFEE AT PERADENIYA.

The young plants of Robusta coffee planted out next the parent plot, have developed both the leaf disease (*Hemeleia vastatrix*) and the scale (*Coccus viridis*) both of which are present to a slight extent on the parent bushes which do not seem to be very much affected in general appearance. These young plants have no established shade.

Some year-old Robusta stumps raised from the same seed, were planted out in June under dense, established shade of *Leucæna glauca*, next a plot of Liberian coffee suffering heavily from both pests and there is no sign of the Robusta plants having been affected from them.—E. S. P. Progress Report.

CASHEW NUTS.

COMMUNICATION FROM A PARIS FIRM.

"We generally pay for these kernels about 40*s* per cwt. nett weight, cases free, goods put up in 2 cwt. cases. This refers to the slightly roasted kernels in order to free them from their hard shell and only the fine thin brown husk adhering to the kernels. We buy annually about 100 tons, and would be extremely pleased if you would kindly put us in contact with one or several serious firms in whose shipments we may have entire faith, as we are disposed to order this stuff, payment against shipping documents. Please note that the above-named price is to be understood c.i.f. Havre, shipment by steamer not touching a European port before coming to France in order to permit us to enter the goods without special duty obtained from all Colonial goods imported into France *via* any European country."—

Trinidad and Tobago Bulletin (March-April).

CACAO CULTIVATION.

DISCUSSION AT THE THIRD INTERNATIONAL CONGRESS OF TROPICAL AGRICULTURE.

The afternoon (of Friday, June 26th) discussion on cacao established the fact more plainly than ever of how widely diverse are the views of the leading authorities as to why and how cacao beans are fermented and which is the best way for the work to be done. M. Perrot was present and discussed his system, whilst Messrs. Booth and Knapp, of Messrs. Cadbury Bros., Ltd., told us about the qualities in cacao that the manufacturers desire, and Mr. Davies, the Chemist, we believe, attached to the works of Messrs. Rowntree & Co., Ltd. (York), disagreed with M. Perrot and the authors who contributed the essays published in our book, "The Fermentation of Cacao." M. Perrot spoke at some length on the subject, but we must own that, with all our willingness to do so, we are unable to reconcile the different opinions advanced by the various authorities. It is the old trouble, noted in our book on p. xxii of the preface, and now M. Perrot's ideas are again different to all the others. Mr. Booth, who read the paper by himself, and Mr. Knapp, warned planters against seeking to dry their cacao too rapidly. We are glad of this, for, as Dr. Sack said (p. xxiii of preface in our book), "Experiments at the same time made it quite clear why the old method, by which the drying was done slowly, yielded a product which far surpassed in quality the cacao that was rapidly dried, for with a slow process of drying the reactions will continue for some considerable time. With rapid drying they will speedily cease." There is no doubt, therefore, that too much attention cannot be paid by engineers who design and make the machines, and planters who use them, to these warnings.

Further comment is not necessary now. Had there been time we would have taken part in the discussion re "fine" and "ordinary" grades. "I know if I were a planter," said Mr. Davies, in no hesitating tone, "I would not ferment my cacao"; but at the same time care, even with the commonest cacao, must be taken to send the beans to market quite sound and free from mould externally and internally, the latter especially. Bahia this year, owing to the floods, etc., has suffered severely through the percentage of unsound cacao it had to export, so that although better prepared than is common to fair West African, it is, at present, not sought after. It is true that some of the low quality, "cheesy" Jamaican, that we see now and then sells low, but we wonder sometimes whether, when the weather is hopelessly bad, it would not pay the Bahia planters better to ship unfermented cacao, as then the beans internally are less liable to become mouldy, and although such cacao would sell low compared with superior, it might still realise better net proceeds than much of what has been exported from Bahia this year, or is still held up country waiting for buyers.

M. LEPLAE Director-General of Agriculture, Colonial Office, Brussels, speaking on the paper by MR. CLAESSENS, also of the Belgian Colonial Office, entitled "Notes on Cacao Cultivation in the Mayumbe District, Belgian Congo," told us that the rainfall in that district was very unevenly distributed throughout the year, there being a long period without any rain at all. Although the trees gave an average yield of 2½ lb. a tree, these spells of drought caused them to die off in about fourteen years, so that the planters were always having to put in new trees and plant up fresh areas. "The only remedy, it seems to me," concluded M. LEPLAE, is to adopt some form of irrigation. Can this be done? Has any one any experience of cacao planting under irrigation, and with what results?" To this a planter, a MR. MAXWELL, we understood, told us during the discussion that in one district in Colombia (South America) irrigation had to be resorte l to and gave satisfactory results. Unfortunately, when the meeting broke up, we were unable to obtain further particulars from MR. MAXWELL, but hope to do so later on. The fact remained, however, that cacao in at least one district had to be irrigated, and was being produced at a profit under irrigation; and discussing the matter afterwards with M. LEPLAE, he told us that in the Colombian case the land was flooded every fortnight or so, when, the soil being of a somewhat sandy nature, the excess of moisture soon drained off and passed through the ground. In Venezuela also, our esteemed Belgian Colleague told us, irrigation was in force, in one case down a hill, when he believed small gullies were cut to guide the water, but that seemed doubtful. Sent broadcast over the land at the side of a hill a serious erosion of soil would ensue, but as it is important, both on the flat as well as on the hill land, to direct the water to the roots we would certainly recommend, where the ground is hilly or even sloping, that the land some 4 feet round the lower side of the tree should be loosened and banked up to catch and check the moisture and holes perhaps made on the upper side of the slopes to conduct the water down to the roots.—TROPICAL LIFE.

THE EXPERIMENT STATION, PERADENIYA.

In September when the Station was looking its very best, a large party of Agricultural Instructors was personally conducted round by the Director, the Secretary of the Ceylon Agricultural Society, and the Manager, and all the cultivation explained to them. On the following day between 40 and 50 Kandyan Village Headmen headed by their Ratemahatmayas were conducted round by the Manager. They all expressed the greatest interest, especially in the Dura and the flour made from it, and were most anxious to secure seed.

On the next day, a large party of students from Trinity College were likewise conducted round.

The Maharajah and Maharanee of Kapurthala were personally shown all over the Station and expressed the greatest interest.

PROFESSOR ARMSTRONG, F.R.S., also made several visits and collected many plants and seeds.—PROGRESS REPORT.

COCONUTS.

COCONUTS AT MAHA-ILUPPALAMA, CEYLON

The eighth picking of 1914 was made on September 9th. The number of nuts collected was 1964 from 353 trees. This gives a total of 11,348 nuts for the pickings of 1914, to date, from an area of 23½ acres, composed of 17 acres of 6 year old and 6½ acres of 7 year old trees (No. of trees per acre being 70).

In the cultivated area (6 year old trees) consisting of 1,224 trees, 315 trees gave 1,815 nuts, an average of 5·75 nuts per tree.

In the uncultivated area (7 year old trees) consisting of 449 trees, 38 trees gave 149 nuts, an average of 4 nuts per tree.

With regard to copra production, the following figures have been obtained :—

Picking.	Break.	Rejections.	Copra lb.	Nuts per candy. (560 lb).
		Combined Plots.		
June	2781	1	1390	1109
	Rat eaten			
July	2364 36	0	1016	1303
		Plot A.		
June	2522	1	1294	1080
July	2193	0	936	1312
		Plot B.		
June	259	1	96	1499
July	171	1	80	1183

—Progress Report, Maha-Iluppalama.

COCONUT CAKE.

Coconut cake is made from the fleshy portion of the coconut after the oil has been extracted. It is not largely used for feeding in this country but is in considerable request on the Continent.

An average sample of coconut cake may contain 22 per cent. of albuminoids and 10 per cent. of oil; it is thus not so rich in flesh-forming substances as linseed cake, but in other respects is not dissimilar to that feeding stuff. On the Continent coconut cake is favoured as a food for dairy stock. It is fed in quantities of from 3 to 4 lb. a day, and is said to be eaten readily. Reliable data as to its uses for stock feeding in this country are lacking. Theoretically it should be about equal to linseed cake, and farmers would be well advised to give it a trial if it can be purchased, as it is not unlikely that it may be, at three-fourths of the price of linseed cake.—

Journal of the Board of Agriculture.

A COMPARISON OF COCONUT CAKE, WHEAT BRAN AND LINSEED CAKE FOR CATTLE FEEDING.

The supply of bran, it is stated, has enormously increased in this country in recent years, owing to the great development of the British milling industry; and its proper utilisation is at present a question of considerable economic importance to agriculturists. Beyond a somewhat limited use in the feeding of dairy cows, and the employment of an even smaller amount in the case of other classes of farm stock, bran has hitherto received little attention from the stock feeders in this country. In composition bran is more like oats than any other feeding stuff. To make up for its low nutritive value, as compared with linseed cake and coconut cake, a slightly larger quantity was allowed in these experiments. The bran used was what is known as medium bran. The supply of coconut cake is gradually increasing, and analysis indicates that it is a rich feeding stuff containing about 10 per cent. oil, 22 per cent. albuminoids and 36 per cent. carbohydrates.

Forty-two two-year old Irish-bred bullocks were divided as equally as possible into six lots each of seven cattle, two lots being fed on each foodstuff. The basal ration was 4 lb. cotton cake, 90 lb. swedes and 12 lb. oat straw; and, after a preliminary period, the quantities of the foods under trial fed were 4 lb. per head per day of each, the quantity of bran being increased to 5 lb. at the end of the second month and to 6 lb. at the end of the third. The bran was fed dry, and the cattle ate it readily out of their ordinary troughs without waste. The coconut cake was steeped in twice its weight of water, but it is stated that the utility of this measure was doubtful seeing that the animals received plenty of swedes.

The increases in live weight were determined after the experiment had proceeded for four months, as some of the animals were then fat. The average increase in live weight per head per day was from linseed cake 2·25 lb.; from coconut cake 1·91 lb.; and from bran 2·02 lb. In reckoning the cost of the increase these foods were taken at their actual cost less the estimated value of their manurial residue; this gave a net food value for linseed cake of £8 13*s.* 9*d.*, coconut cake £6 15*s.* and bran £5 1*s.* 3*d.* per ton. The cost of feeding per cwt. live weight increase was:—linseed cake 44*s.* 4½*d.*, coconut cake 48*s.* 5*d.*, and bran 44*s.* 1½*d.*

Twenty-seven of the cattle, representing equally each kind of feeding, were marketed for comparison; the average prices realised per cwt. were:—linseed cake lot 42*s.* 8*d.*, coconut cake lot 42*s.* 10*d.*, and bran lot 43*s.* 4*d.* These prices were not, however, made a basis for comparison, the live weight

in all cases being reckoned at 41*s.* per cwt., with the following financial results:—

	Linseed Cake			Coconut Cake			Bran.		
	c.	q.	lb.	c.	q.	lb.	c.	q.	lb.
Weight at start—14 store bullocks ...	126	2	26	129	1	11	128	2	2
Weight at finish—14 fat bullocks ...	158	1	3	156	0	2	156	3	10
Total increase	31	2	5	26	2	19	28	1	8
	£.	s.	d.	£.	s.	d.	£.	s.	d.
Net cost of food consumed ...	70	0	0	64	11	6	62	10	2
Value at start at 34*s.* per cwt. ..	215	8	10	219	17	10	218	9	7
Value at finish at 41*s.* per cwt. ...	324	9	4	319	16	9	321	7	0
Difference gross profit	39	0	6	35	7	5	40	7	3
Gain (+) or loss (—) compared with linseed cake fed cattle		—		—3	13	1	+1	6	9

These figures indicate that the outlay on bran brought £1 6*s.* 9*d.* more profit, and on coconut cake £3 13*s.* 1*d.* less profit than the outlay on linseed cake. The experiment shows that when linseed cake costs £10 11*s.* 3*d.* per ton, coconut cake and bran are worth respectively £7 1*s.* 5*d.* and £6 16*s.* 10*d.*, whereas the prices actually paid for these two foods were respectively £8 7*s.* 6*d.* and £6 8*s.* 9*d.* The feeder could therefore, have afforded to pay 8*s.* 1*d.* more per ton for his bran and yet have made the same profit as from linseed cake.

Reports as to the quality of the beef were obtained from purchasers, who in most cases not only killed the animals but cut up the beef and retailed it from their shops. These reports testified to the high quality of the beef, no distinctions being made. The cattle fed on linseed cake yielded 58·55 per cent. of the live weight as dressed carcass, those on coconut cake 58·67 and those on bran 60 per cent.—JOURNAL OF THE BOARD OF AGRICULTURE.

SORGHUM.

Most work in the way of selection is in progress at Hagari where the object in view is not only to get a heavier yielding strain but also, if possible, to get that on a plant with a dull grey midrib along the leaf. It is found that there are two well marked lines, one in which the midrib of the leaf is dead white colour, is pithy and does not make succulent fodder, the other in which the midrib is a dull grey, is a sweeter plant and gives better fodder. The results are not complete yet and some of the seed selected had obviously been cross-fertilised because in one case at least the resulting plants split up on true Mendelian lines. At Koilpatti and Coimbatore, Periya manjal cholam sown thickly formed an excellent fodder crop. At Coimbatore the land had been carefully cultivated and in spite of the dry weather an average yield of 670 lb. per acre was obtained from the dry land. Seed for trial in subsequent years was selected from some of the plants which had most obviously resisted the drought best.—MADRAS AGRICULTURAL DEPARTMENT REPORT.

RICE.

THE PADDY INDUSTRY IN CEYLON.

MR. A. W. BEVEN'S paper on the extension of Paddy Cultivation read at the Meeting of the Ceylon Agricultural Society on November 24th last which we reproduce below, gave rise to a discussion which illustrated the divergent views of the speakers, all of whom must be considered as authorities on the subject, and the complexity of the subject itself. Confining ourselves for the moment to the title of the paper, paddy cultivation can only be extended by enlarging the area under crop. There are extensive tracts of land available under restored tanks; probably 40,000 acres of irrigable land in the North-Central Province alone. The immediate problem is how to get these unoccupied lands utilised; to ascertain the obstacles in the way and devise means for removing them.

As to whether paddy growing is or is not a remunerative crop depends upon the interpretation we place upon the word remuneration. To the employer of labour an unremunerative crop means one which does not return by its sale in the market sufficient money to cover the cost of production with a margin over to permit of resonable interest, on capital. To the peasant cultivator it means that he could get better return for his labour by selling it in the labour market or by cultivating some other crop, which would depend upon the rate of wages and the market price of other crops besides paddy. It also depends upon the terms upon which he can borrow his seed paddy and hire his buffaloes. In many cases he is weighted down with a load of debt the removal of which is for him in reality the urgent business.

But as we remarked on a previous occasion, the industry is not to be viewed from the purely utilitarian standpoint. His paddy fields are to the cultivator in Ceylon what the vineyards are to the peasantry of Southern Europe; a link with the past perpetuating ancient tradition and custom on which the social life of the people is largely nourished; worth more to the country than can be expressed by balance sheets.

Coming to the purely agricultural side of the question it is well known not only in Ceylon but in paddy land throughout the world that a larger crop can be raised by transplanting than direct from seed. But transplanting is laborious and expensive and there must always be localities where circumstances such as thinness of population or low-priced land would make transplanting unprofitable. It has also been shown that seeding is too heavy in Ceylon. In the Annual Report of the Department of Agriculture for 1912-13 there is an account of experiments at Maha-iluppalama to ascertain to what extent heavy seeding is practiced in Ceylon. In one experiment with a 4 months paddy 43¼ bushels (per acre) were obtained from a seeding of ¼ bushel as against 37½ bushels from 1 bushel; with a 3 months paddy 37 bushels from ½ a bushel, compared with 38 from a sowing of 2½. Two bushels per acre is the usual sowing in Ceylon, one at least of these could be saved, the equivalent for the whole island of the product of about 50,000 acres of land. This is an instance in which local influence exercised by members of the Society throughout the country could do an immense amount of good.

THE EXTENSION OF PADDY CULTIVATION.

A. W. BEVEN.

Paper read at the meeting of the Ceylon Agricultural Society, November 24th, 1914.

This is a subject of the utmost importance both to the indigenous population and to the European colonist.

It has been noticed, with much concern, by Planters in the lower districts, that large areas of paddy land, in the neighbourhood of Rubber Estates especially, have gone out of cultivation in recent years, and the subject was brought before the Committee of Agricultural Experiments by a late Chairman of the Planters' Association.—MR. F. H. LAYARD.

The reason for the contraction of the area under Paddy is well known to those acquainted with its cultivation. Paddy cultivation is the least remunerative of all occupations. The "goiya" engages in it, for sentimental reasons and because, in many instances, he cannot cultivate any other product on the marshy fields. A very great boast of the "goiya" is, that he eats the rice raised by him. If enquiry be made in the villages of the status of a would-be bridegroom, the boast of the father and mother of the bride is—that he does not eat imported rice. That is his greatest qualification. It may then be asked why people abandon a national occupation of which they are justly proud? It is because work on rubber estates gives whole families constant employment and remunerative wages. In passing, I may remark that villagers work on coconut estates only when they are not engaged on their paddy-fields.

The problem for the Department of Agriculture and the Agricultural Society to solve is—how to make the cultivation of paddy *more remunerative and more attractive?* Nothing appeals to the "goiya" better than object lessons. I do not say that the Agricultural Society is idle in this respect and is doing nothing. School Gardens have been established all over the Island and their number is increasing, but these gardens are chiefly for the cultivation of fruits and vegetables.

I suggested before now that experimental paddy cultivation should be carried on in connection with every village school in the Island, wherever practicable. MR. LYNE, the worthy and highly respected Director of Agriculture in a letter to me dated the 9th of January, 1914, wrote:—"I am sorry you were not able to come to our meeting yesterday, when we decided upon establishing demonstration plots to carry out suggestions made by you and others for the improvement of the cultivation of paddy. We had a very successful meeting and PROFESSOR DUNSTAN was there." I make this

quotation to show that I have been doing my little best at the meetings of the Agricultural Experiments Committee to awaken an interest in the extension of paddy cultivation. What can be done at those meetings with a few members cannot be compared to what can be done at a meeting like this, under the presidency of so sympathetic a Ruler as HIS EXCELLENCY has amply demonstrated he is. One appeals here to an audience many hundred fold larger than is assembled here to-day.

I am very interested in this question, and I appeal with all the earnestness at my command, to HIS EXCELLENCY and to the Department and Society of Agriculture, to do all in their power to extend the cultivation of paddy, by increasing many thousand-fold the experimental plots for the cultivation of paddy. At present the material at the disposal of the Department of Agriculture is sadly inadequate. True, a few lads have been sent to Poona to study Agriculture, but what are they among so many places that require their services? Rome was not built in a day, and the work of cultivating paddy on improved lines cannot be accomplished in a day; but it can be done very much faster than at the present time.

All village schoolmasters will have to pass in elementary agriculture and to go through a course of practical agriculture in schools which will have to be established, not only in the Capitals of every Province, but also in every seat of an Asst. Government Agency. The teachers should be taught in these schools how to prepare paddy fields and seed-beds, to select seed paddy, to transplant and all the other operations of improved paddy cultivation. The Co-operative Societies can step in and afford not only monetary help but will have to distribute selected seed paddy, hire out improved ploughs and sell suitable manure mixtures. With improved methods of cultivation, the yield of paddy cannot but increase and will wean "goiyas" from new pursuits and will gradually draw them back to their ancestral and highly respectable national calling.

It will be presumptuous on my part to state what the improved methods of cultivation should be, to so highly qualified gentlemen as compose the Department of Agriculture. As a practical layman I may be permitted to throw out a suggestion. Without going farther afield than along our lines of Railway, travellers will notice large tracts of paddy fields lying fallow, as they depend on rainfall for their irrigation. The principles of Dry Farming can be demonstrated on these fields and they can grow on them other products than paddy—by preference leguminous crops. It will be Dry Farming in a modified form, for in no place in the Island is it absolutely rainless, and rain will fall between sowing time and harvest.

I have referred so far only to the populated regions of the Island, but there are vast tracts which are lying waste for want of population. Some of these places are arid and some can be irrigated by the vast tanks restored by Government at immense cost. These tanks yield very little returns to Government. The paternal encouragement of the Government is wanted to populate these wastes and to bring them under the axe and mamotie of the cultivator.

First as to the arid regions. Here, Dry Farming in a modified form will have to be practised, for, as I stated before, no part of the Island is absolutely rainless. Dry Farming as an agricultural operation has the active sympathy

of Mr. Lyne, the Director of Agriculture. In the letter to me, of the 9th January last, from which I quoted before, he wrote :—" At the International Congress of Tropical Agriculture to be held in London in June and July next, I hope to be able to read a Paper on the subject of Dry Farming in the Tropics, which is arousing considerable interest in other countries besides Ceylon. But I hope Ceylon will be able to lead the way in the matter of practical experiment." There is much encouragement in the preceding to those who, like myself, wish to find Dry Farming emerge from the state of an experiment to a recognised practice. In the Chilaw district, a prominent resident owns about 50 acres of paddy land which is lying fallow and useless owing to want of irrigation facilities. In a letter to me, he said he was prepared to place these fields at the disposal of the Agricultural Society for the purposes of experiment. Advantage can be taken of this offer, and the possibilities of Dry Farming can be brought home to hundreds in the neighbourhood who have lands similarly situated.

In the desert wastes where there is no population, a paternal Government will have to step in and populate them. I was discussing this subject once in a railway carriage with the most prominent Sinhalese gentleman in Ceylon. He was of opinion that the planting of colonies of villagers in the uninhabited wastes of the Island can be successfully carried out only under the patronage of the Government. Land, on easy terms of payment, should be given to landless villagers of good repute, recommended by chief headmen. Recoveries of purchase moneys should be made in easy instalments, only after the lands begin to yield returns. Till then, the settlers should receive help for their requirements. A Protector of Settlers should be appointed, who must be an Agriculturist and can direct agricultural operations. One of his duties should be to disburse the help the settlers should receive and debit it against each individual or family. A Field Hospital will have to be established, where the ailments of the settlers will have to be attended to. A market will have to be found for the surplus produce of the settlers. This is a crude scheme which was discussed during a railway journey and which will have to be elaborated. I commend it to the sympathetic consideration of the Government.

The European Colonist has a great interest in the extension of paddy cultivation, as he is materially affected by its restriction. In every annual report of Planting Companies, one reads of large losses on rice sustained by them and which seriously affects dividends. What the aggregate of these losses are, I am unable to state. The Secretary of the Planters' Association, to whom I applied for information, very courteously wrote to me :—" From enquiries I instituted it was estimated that the loss on rice incurred by estates amounted to 48 cents per acre in 1911 ; Rs. 1·75 per acre in 1912 and Rs. 3·17 per acre in 1913. The acreage under cultivation on European managed estates for these three years are 190,494 ; 192,721 ; and 190,158 acres respectively. The loss on rice in 1911 will have been Rs. 92,437·12 ; in 1912 Rs. 337,261·75 and in 1913 Rs. 632,800·86.*

* Mr. Beven writing to the Observer on November 25th states that the total loss on all European-managed estates in 1913 would be Rs. 1,902,000 according to figures subsequently furnished him.

I am indebted to the compilers of the Ceylon Directory, familiarly known as the "Ceylon Enquire Within upon Everything," for some figures courteously placed at my disposal. The estimated area under Paddy in 1913 was 671,711 acres and the estimated yield 9,622,320 bushels, or about 15 bushels per acre. With due deference, I think that this estimate of yield is high for the whole Island. There are districts where the yield is higher than 15 bushels per acre, but in the majority of fields the yield is much less, though it works out at $7\frac{1}{2}$ fold only. With seed selection, proper preparation of land, suitable manures and transplanting, the average yield per acre can, at a very moderate calculation, be increased to 25 bushels per acre, or to 16,792,775 bushels per annum. That this is not an impossibility is borne testimony to by MR. PETCH in his admirable leading article in the TROPICAL AGRICULTURIST for July last :—"In Java, a variety which yields $2\frac{1}{2}$ tons of rice per acre has already been raised in the Experiment Station at Buitenzorg. That Ceylon rices will lend themselves to improvement by this method (selection of seed) is evident from the fact that the best variety now under cultivation in British Guiana was obtained by selection from a Ceylon consignment."

The increased yield I suggested as possible was with the present area under cultivation. If, as I suggest, the area be increased, will I be considered an optimist if I suggest, that in the near future the annual yield will reach 20 million bushels per annum ? To reach this goal, the number of Agricultural Instructors will have to be very largely increased and the Co-operative Societies will have to very actively help the "goiya." With an increased local production of paddy, the indigenous population will become less and less dependent on imported rice, and the rice at the disposal of the planting community will be obtained cheaper than now.

When discussing the subject of the extension of paddy cultivation with a leading up-country Planter and Visiting Agent, he told me that during the regimé of the late SIR WILLIAM GREGORY—when there was great activity in the restoration of the ancient tanks in the North-Central Province—the late lamented SIR GRAEME ELPHINSTONE, whose name is yet remembered with affection in the Island, asked the Government for the grant of large tracts of land under the tanks on special terms, to settle old kanganies on. Those were the days when King Coffee reigned supreme. After crop, most of the coolies were paid off and went to the Coast and returned about August, in time for crop, which commenced in September. The idea was, instead of paying off coolies, to send them to the tank region to cultivate paddy and to recall them at crop time. If this idea came to fruition, two large problems which now vex the Planting Community would have been solved—loss on rice and shortage of labour. The Island would have had a large locally-resident labour force who would also have been large producers of Rice. Unfortunately, the planters could not accept the terms proposed by the Government, and an excellent scheme fell through, and the Government and Planting Community are the poorer for it. I believe that at the present time the Planters' Association is elaborating a Scheme somewhat similar to what I have sketched. It is to be hoped that it will meet with greater practical sympathy than the previous one.

COTTON.

A NEW SYSTEM OF COTTON CULTURE.

O. F. COOK, DEPARTMENT OF AGRICULTURE, U. S. A.

The way to secure an early short-season crop of cotton is to thin the plants later and leave them closer together in the rows than is now customary. Neither of these policies is advisable if used alone, but they give a real advantage when properly combined. Keeping the plants closer together during the early stages of growth restricts the formation of vegetative branches and induces an earlier development of fruiting branches. The new system is based on the principle of controlling the formation of the branches.

CONTROLLING THE FORMATION OF BRANCHES.

The principle of branch control is more likely to be understood if studied as the basis of a new cultural system. Application of the principle will involve a reconsideration of all current opinions regarding such questions as distances between rows, times of planting, methods of cultivation, and the values of different varieties. The spacing of the plants and the stages at which thinning should be done will depend upon the local conditions and habits of the varieties that are being grown, so that it will not be possible to give specific directions that can be used everywhere without discrimination. In agriculture, as in other arts, every new application of a scientific principle makes an additional demand for intelligence and insight into the problems of production. The contrasts with prevalent theories and practices of cotton culture are so great that careful consideration of the habits of the cotton plant is needed before the full possibilities of cultural improvement can be appreciated.

The first step towards permanent progress in the new direction is to secure the attention of the intelligent farmer to the principle itself, so that he can begin to observe and experiment on his own account with rows of cotton thinned to different distances and at different stages of growth and thus see for himself the relation of the habits of the plants to the cultural problems. In this case no special equipment of books or instruments is necessary to enable the farmer to study the plant and learn what he needs to know regarding its habits of branching. It is true that these habits are somewhat peculiar from the botanical and biological standpoint, as already pointed out in preceding papers on the subject, but there are no technicalities that interfere in any way with direct observations of the behaviour of the plants under the usual farm conditions.

APPLICATION OF IMPROVED METHODS.

Unless the farmer can understand the underlying reasons, he is not likely to adopt a new method or to apply it properly, any more than he can use a new machine to advantage without knowing how it works. This requirement of intelligence may limit the application of an improved method, just as it restricts the use of high-grade machines to those who have the ability to

handle them properly and understand their construction. But it is generally agreed that larger rewards for more intelligent and skilful farming are in the interest of agricultural progress, and this is especially true in relation to the cotton industry. To make it seem worth while for intelligent men to remain on the farm would soon counteract the urban tendencies now so much deplored.

That cotton has been considered a "sure crop" even with the most careless farming, is one of the chief reasons for the backward state of the industry. But the need of improvement is now recognized as never before, as a result of the many changes that are being enforced by the invasion of the boll weevil. With the continued advance of the boll weevil the period of sure-crop cotton is drawing to a close, and the rapid expansion of cotton culture in foreign countries shows that a new test of competition in the production of this crop must be met in a few years. In the meantime any improvement that promises increased efficiency of production is worthy of careful consideration.

IMPORTANCE OF STIMULATING EARLINESS.

The chief advantage of the new system of cotton culture, based on the improved method of thinning, is the increased earliness of the crop: or, in other words, the production of more cotton in a shorter period of time. The need of shortening the growing season of cotton has been recognised as the best solution of the problem of securing protection against injury from the boll weevil, but is no less important in regions where the crop is limited by drought or by short seasons, as in the northern districts of the cotton belt.

CONFLICTING OPINION ON SPACING COTTON ROWS.

Many intelligent farmers are aware of the fact that rows of cotton accidentally left without thinning are sometimes much more productive than rows that were thinned in the usual manner and have reflected on the possibility of securing larger crops by closer planting, but the underlying biological principle has not been understood. The behaviour of cotton in different seasons or under different conditions is so extremely variable that any intelligent farmer might well hesitate to adopt a method of culture suggested by an occasional occurrence like the production of a larger crop on an unthinned row.

In each cotton-growing community there are usually some farmers who believe that cotton should be left closer together in the rows, but the tendency in recent years has been towards wider spacing, owing to a general recognition of the evil effects of having the plants too close together, especially under conditions that favour luxuriant growth. Those who use narrow spacing may boast of phenomenal yields in some seasons, but in other years they appear at a disadvantage with their neighbours. The possibility of making a safe combination of the two conflicting methods seems not to have been suggested. The same conflict is shown in the results of formal experiments to determine the best planting distances as in the popular opinions on the subject. Wide spacing in the rows seemed better in some cases and narrow spacing in others, so that no definite conclusions could be reached.

LARGE PLANTS PRODUCE LATE CROPS.

When the habits of the cotton plant are taken into account it becomes apparent that the theory of wider planting has its limitations, as well as the theory of closer planting. To reduce the number of plants by wider spacing in the rows means that a longer period of time is required to produce a crop, for the reason that large luxuriant plants do not begin to produce flowers and bolls as early as plants of more restricted growth. This is not in accord with what might be considered as the most logical view of the subject. Most people are ready to argue that the plants making the most rapid growth must produce the earliest and largest crop, but the actual behaviour of the cotton plant is otherwise. In such cases the biological facts have to be taken into account instead of relying upon the logical deductions.

The biological fact in the present case is that the large luxuriant plants are later in setting and maturing a crop. This is because the young plants in a condition of luxuriant growth develop vegetative limbs at the expense of the lower fruiting branches that are necessary to the production of an early crop. The cotton plant has two different kinds of branches—vegetative branches, sometimes called "wood limbs," which correspond to the main stalk of the plant, and fruiting branches, which produce the flowers and bolls.

When the habits of branching are understood it becomes apparent that the idea of the largest plants producing the earliest and largest crops does not apply to cotton. Spreading, treelike plants, with numerous vegetative branches, do not represent a favourable condition for earliness or for large yields in short seasons. In the interest of correct thinking on cultural problems the row rather than the individual plant should be considered as the unit. The advantages of the new method are gained by improving the form of the rows. More plants are left in the rows, and yet injurious crowding is avoided. Plants that have numerous vegetative branches are more crowded at 2 or 3 feet than plants with single stalks at 8 or 10 inches. With the vegetative branches controlled, the spacing is no longer a question of feet, but of inches. Rows spaced at 6 inches have usually given better results than those at 12 inches or greater distance.

EXPOSURE OF FRUITING BRANCHES TO LIGHT.

By avoiding the development of the large wood limbs the rows are kept narrower and more hedgelike, so that the fruiting branches receive sunlight throughout the season. This provides much more favourable conditions for the ripening of the crop. When the vegetative branches are allowed to shut off the light by growing up between the rows, most of the bolls on the lower fruiting branches fail to reach normal maturity. Fields of large luxuriant plants often produce very small crops because only the upright growing ends of the stalks and vegetative branches have access to the light. This undesirable condition is avoided by restricting the development of the vegetative branches in the earlier stages of growth.

Numerous experiments have demonstrated the fact that the usual custom of giving the seedlings full exposure by thinning them to wide distances in the rows is a means of inducing the development of large numbers of vegetative limbs. Too much exposure for the young plants results in too little exposure for the adults by increasing the number of vegetative branches. The

effect of exposure at wide distances is influenced, of course, by temperature and fertility of soil, larger numbers of vegetative limbs being produced under conditions that favour the luxuriant growth of the plants. But it does not appear that the production of vegetative branches is desirable under any condition. The improved method of thinning restricts the development of vegetative limbs or avoids their formation altogether. This permits a better development of the fruiting branches of the lower part of the main stalk. The plants are induced to fruit earlier and the crop is made larger because more of the early plants can be grown on the same area.

COMPETITION BETWEEN TWO KINDS OF BRANCHES.

The reason this possibility of cultural improvement has not received adequate consideration in the past is doubtless to be found in the fact that the distinctness of the two kinds of branches has not been recognised, nor the relation of this specialization to the method of thinning. When the plants are thinned too young, so as to stand more than six inches apart, they put forth a full quota of vegetative limbs, and the subsequent competition and crowding of these limbs with each other and with the main stalks interfere with the development of normal fruiting branches. As it is the low joints of the stalk that produce the undesirable vegetative branches, the plants must be allowed to grow beyond these joints before thinning. Exposure of the stalk to the light in the early stages of growth is one of the factors that lead to the putting forth of the vegetative branches.

EFFECTS OF EXTERNAL CONDITIONS ON BRANCH FORMATION.

The number of vegetative branches is also influenced by temperature and soil conditions. If the weather remains cool, or if the soil is very dry, not many vegetative branches will develop, even when the young plants are widely separated. But if the conditions favour a luxuriant development of the young plants, early thinning will result in the development of a large number of vegetative branches, and the subsequent crowding will be great. Even in the absence of any disease or insect pests the crop may be ruined by crowding alone. Thus, the extent of the injury from crowding depends very largely on the conditions that obtain during the early development of the plant when the formation of vegetative branches is determined.

Until the habits of the branching are taken into account, it seems impossible to explain the widely different results that are often secured when the same experiments are repeated in different places or in the same place in different seasons. From the present point of view, it is easy to understand that merely statistical experiments made without recognizing the effects of different methods of thinning upon the formation of branches would be likely to reach only ambiguous results. The development of the branches though very easily influenced in the early stages of growth, completely alters the subsequent behaviour of the plants. The effect seems out of all proportion to the exciting cause, like touching off a charge of powder or pulling the trigger of a gun.

Wider spacing appears as the only alternative as long as the young plants are led to put forth a full equipment of vegetative limbs by too much exposure in the early stages of growth. That the development of these limbs

may be avoided by a later and more gradual thinning of the young plants must be recognized before it is possible to understand the advantages of the new system. When good crops are produced on rows that are not thinned at all, it is because the plants remain so close together that no vegetative limbs are developed. The new system provides for a more regular and effective application of the same principle of suppression of vegetative branches.

WHY FARMERS ARE ADVISED TO TRY THINNING EXPERIMENTS.

Farmers are advised to experiment with the new system in order to learn how to use it. The experiments that have been made by the Department of Agriculture leave no doubt of the practical advantages that are to be gained by suppressing the vegetative branches, but it is not expected that the farmer will secure a practical familiarity with the system merely by reading about the experiments that others have made.

How long the thinning should be delayed to suppress the vegetative branches and how close the plants should be left in the rows are questions that the skilful farmer should learn to determine for himself, since the actual conditions must be taken into account to secure the best results. If the farmer does not look into the subject far enough to grasp the underlying principle, he is not likely to be able to appreciate the new method or to use it to the best advantage. Hence no explicit directions were used when the new system was announced, but farmers were advised to study the matter for themselves and to make experiments with a few rows of cotton in order to see that they really understand the principle and to make sure that they are able to secure an advantage from it before attempting to apply it to their whole crop.

The two features of the new system—deferred thinning and close spacing—must be properly combined in order to insure a favourable result. Most farmers believe that either of these changes will injure the crop, and the danger is that they will try one change without the other instead of making a complete break with previous theories and methods. Until the principle of branch control is understood it is difficult to believe that two apparently injurious changes can have a beneficial result. Attention must be called to the peculiar structure and habits of the cotton plant, in order to place in the hands of the farmer this new power of controlling the development of his crop. The introduction and general utilization of the new system is hardly to be expected without a campaign of education. Not many farmers will be able to believe the new doctrine, and still fewer will apply it successfully merely from reading or hearing about it. They must be induced to try the experiment for themselves, and to encourage this tendency nothing is so good as an example.—INDIAN AGRICULTURIST.

TOBACCO.

INFLUENCE OF SOIL ON TOBACCO.

The aim of the tobacco grower is to obtain a fragrant leaf with good burning qualities. Heavy loam, clay, or peat soils will not do this. The plant being of tropical origin, a warm soil is essential, and one with but moderate quantities of organic matter produces the leaf of finest texture. Rank organic manures must be avoided, as well as all materials containing chlorine. The fine gold leaf tobacco of North Carolina is grown upon a light gravelly soil. A red clay sometimes produces a fine, rich, mahogany-coloured leaf of high value. Limestone soils, too, will yield high-grade tobacco. Potash is of the utmost importance to this crop, which consumes large quantities of it, but in order to obtain a leaf that will burn well, all the forms of potash salts containing chlorine, such as kainit or muriate, must be avoided. Stable manure is preferably applied to the crop preceding tobacco. The 600 lb. per acre of a fertiliser containing available phosphoric acid, 7 per cent., potash, 10 per cent., nitrogen, $3\frac{1}{2}$ per cent. Nitrogen in the form of dried blood meal gives profitable results.—QUEENSLAND AGRICULTURAL JOURNAL.

THE GROWTH OF TOBACCO FOR NICOTIN EXTRACTION.

G. H. GARRAD.

The following summarised account appears in the Experiment Station Record:—This paper discusses the value of nicotin as an insecticide, the factors influencing the nicotin content of tobacco (variety, soil and climate, manuring, time of harvesting, and spacing of plants), the botanical characters of tobacco, and the practical management of the crop.

The results of the experiments of 1910 showed (1) that a rich soil produced a higher percentage of nicotin, (2) that an excess of nitrogenous fertilizer seemed to increase the nicotin content, (3) that spacing the plants $1\frac{1}{2}$ by 3 ft. apart gave the greatest yields of nicotin per acre, (4) that neglect to top or disbud reduced the yield of nicotin, and (5) that low topping (at 8 to 10 leaves) gave greater yields than high topping. In 1911 the reverse was true in regard to topping.

The best time to cut was found to be at maturity. Varieties of *Nicotiana rustica* seem to contain a higher percentage of nicotin than those of *N. Tabacum*. It is noted that a yield of from 70 to 150 lb. of nicotin per acre may be expected. Analytical data are given in tabular form.

FRUIT.

BANANAS AT PERADENIYA.

By continually cutting off and burning the diseased, yellow leaves of plants affected with *Fusarium*, the disease seems to be satisfactorily checked.

Practically the whole of the first crop of bunches has been cut, save in the Red Plantains which take 15 months fully to mature, against the 10-12 of the other varieties.

In the Puwalu variety the parent plant was cut on 17th July, i.e., at eleven months and the two ratoons flowered 2 months later, yielding bunches fit to cut in 3 months' time. That is, this variety will yield 3 bunches worth 35 cents each, in 16 months.

It has been said that the bunches in these plots are small compared to those elsewhere, but this may be due either to the elevation or to the fact that Ceylon varieties are supposed to give larger bunches from the ratoons than from the parent—a reversal to that which takes place in the West Indies. But in any case, planting according to the West Indian methods has resulted here in earlier fruiting than planting in the ordinary Ceylon manner.—

E. S. P. Progress Report.

TOMATO TRIALS, RAROTONGA PUA-AU NURSERY.

E. A. REID.

The seed was sown early in April in seed boxes dimensions 14 in. × 12 in. × 4 in. Holes were first bored in the bottoms of these boxes—then a layer of gravel to ensure proper drainage; the box then being filled with sieved earth placed in a half-shade seed house and the tomato seed sown. A rough framework roofed with split bamboo makes a useful shade house and affords necessary protection to young seedlings in the tropics. When the young tomato plants were sufficiently grown, they were "pricked out" into boxes of same dimensions as formely stated—distance between plants 3 in. × 2 in. In twelve to fourteen days the plants were strong and stocky, and proved excellent for transplanting to the permanent rows. These rows were planted 4 ft. × 3 ft. but if ample ground is available I should recommend 4 ft. × 4 ft. thus enabling the horse cultivator to be worked both ways.

Twenty plants of each variety were grown. The single stem system was adopted for training and this system is absolutely the best. (1) It allows of free cultivation. (2) There is no superfluous growth to shelter insect pests and fungus disease, thus enabling spraying for their control to be easily and thoroughly accomplished. (3) The plant is under complete control and to get the best results this is imperative.

In training for single stem 5 ft. stakes were used and as the plant developed it was securely tied to the stake and all lateral growths removed. When a truss of fruit was well set the immediate overhanging leaf was cut away, thus preventing shelter to caterpillars attacking the fruit—the only other leaves removed are those which come in contact with the ground at foot of the plant and these are only cut away when the plant is well developed. The plants are headed or "stopped" at first leaf above sixth truss—but five trusses are sufficient for a commercial plant, as reliance can then be placed on practically all fruits being fully developed. All leaves growing from the truss of fruit should be removed, thus giving the fruit the full benefit of nourishment. The plants were sprayed every 12 to 14 days with Arsenate of Lead, proportion 1 lb. to 30 gallons water and attacks by caterpillars were effectively prevented. Spraying must be thorough, as the depredations by this pest are very severe in the tropics. An Eclair Vermorel Knapsack pump was used, with elbow extensions; this extension enables the underside of the leaves to be sprayed without trouble. Where fungus diseases are troublesome the combined spray—Arsenate of Lead and Bordeaux—is recommended. The Bordeaux formula is Roche Lime 6 lb., Sulp. of Copper (Bluestone) 4 lb. to 50 gallons of water, to this add 1½ lb. Arsenate of Lead. The following is record of weight of commercial fruit gathered from each variety.

Variety.	*Total yield.*	*Yield per plant.*
Large Red	232½ lb.	11·6 lb.
Market Favourite	229	11·4
Early Ruby	215	10·7
Trophy	202	10·1

PALM-NUT CAKE.

Palm-nut cake is made by pressing the kernels of the nuts of the oil palm, a species of palm that is grown extensively in the West African Colonies and Protectorate. Almost the whole export of this product has hitherto gone to Germany, where large factories have been erected for crushing the kernels and preparing the products for market. It is hoped that it may now be possible to arrange for the crushing of palm-nut kernel in this country. The kernel contains about 50 per cent. of oil, and after crushing is sold in the form of either cake or meal containing about 10 per cent. of oil and 16 per cent. of albuminoids. The meal is sometimes further treated with chemical solvents and its content of oil may then be reduced to as little as 1·5 per cent.

Palm-nut oil, which is largely used for human food, is very suitable for certain classes of stock, and while there is not sufficient information available to enable a definite comparison to be made between palm-nut and linseed oils, the experience of foreign stock-feeders would appear to indicate that palm-nut cake would make a very good substitute for linseed cake in feeding dairy cattle. Cows may receive up to 5 lb. per head per day.

Palm-nut cake does not keep so well as linseed or cotton cakes, and users should not lay in large stocks.—JOURNAL OF THE BOARD OF AGRICULTURE.

COLLEGE OF TROPICAL AGRICULTURE.

Report to the Committee on the proceedings of the London Committee for promoting the establishment of an Imperial College of Tropical Agriculture which met in London on the 10th of July last.

COMMUNICATED TO THE BOARD OF AGRICULTURE.

It will be recalled that when in February, 1913, the Board of Agriculture first took up the question of a College of Tropical Agriculture it appointed a Committee. That Committee invited 15 gentlemen, including SIR HENRY MCCALLUM, SIR HENRY BLAKE and SIR WEST RIDGEWAY, to form themselves into a London Committee to urge the claims of Ceylon as being the most suitable site for an Imperial College of Tropical Agriculture.

The London Committee have carried out their task in a manner very satisfactory to Ceylon. The West Indies, whose activities first directed our attention to the necessity of bestirring ourselves, now agree that Peradeniya's claims are unrivalled and not only will they not oppose them but will, I think, support them. They would probably expect in return our support for the West Indies as the site for a second college if a second were ever contemplated as no doubt in the course of time it will be.

At the International Congress of Agriculture held at the Imperial Institute in June of this year a resolution was passed supporting a proposal to establish an Imperial College of Agriculture in the British Tropics and appointing a Committee to co-operate with the London Committee.

It was then resolved that these two Committees should in future form one Committee with the title "General Committee for Promoting the Establishment of an Imperial College of Tropical Agriculture."

This was announced at a meeting of the London Committee held at the Chambers of the Ceylon Association in London on July 10th. This meeting had been called at my request as I wished to take back with me to Ceylon an answer to a report that had been sent them by the Ceylon Committee on February 3rd, 1914.

This report had reference principally to the arrangement of hostels for housing the students at the proposed College. The Chairman, SIR HENRY MCCALLUM, stated at the meeting that he, SIR HENRY BLAKE and PROFESSOR DUNSTAN had discussed with MESSRS. JAMES PEIRIS and W. A. DE SILVA, two members of the Ceylon Committee, the difficulty which had arisen as to hostels, and it was agreed that the elimination from the general scheme for the building and endowment of the College of provision for the erection of hostels, which would be met by separate subscriptions, would overcome the difficulties raised.

A report of the proceedings at the meeting sent to the Secretary, Ceylon Agricultural Society, goes on to state "After discussion, the Committee resolved that it is desirable to proceed separately with the foundation of the College and of the Hostels, the cost of the Hostel for European students to be raised by European subscription and Hostels for other nationalities by subscriptions from the nationalities concerned.

"MR. DE SILVA in reply to a question to MR. LYNE stated that in his opinion the proposal now made by the Committee as to Hostels would be entirely satisfactory to the Ceylonese.

"The Committee further resolved to take steps to raise £40,000 for building and endowing the College—£20,000 to be asked for from the Governments concerned, including India, and £20,000 to be raised by subscription conditionally on the Governments contributing the same sum. It was also resolved to collect £5,000 for the erection of a Hostel for European students."

Several representative names from India and other parts of the Empire have been added to the Committee including those of LORD KITCHENER from Egypt and SIR OWEN PHILIPPS from South Africa.

This General Committee is not committed to Ceylon as the site for the Imperial College. If circumstances arose making it undesirable for the College to go to Ceylon the Committee would advocate its being established elsewhere. This was especially pointed out at the meeting in London at which I was present. At the same time Ceylon was the place most favoured. In his Presidential Address at the opening of the Congress of Tropical Agriculture, PROFESSOR DUNSTAN in describing the conditions necessary for a College of Tropical Agriculture said that "It can hardly be questioned that, all things considered, that which is now called the Middle East has the first and best claims to the site of such an institution, and that Ceylon is the country best adapted for the purpose." Further on he said "The Government of Ceylon is understood to be favourable to the proposal, and the Secretary of State for the Colonies has declared his interest in and sympathy with the scheme." And again "It is proposed, if the proper arrangements can be made, to place the College at Peradeniya, in Ceylon, in proximity to the famous gardens and also to the Government Agricultural Department."

About a month after the meeting I talked the matter over with PROFESSOR DUNSTAN at the Imperial Institute. There can be no doubt that the General Committee will work for the College to be established in Ceylon.

That is the position at which we have now arrived. The Ceylon and London Committees have formulated the general outline of the College scheme but a difficult task remains to be accomplished, namely, the raising of the money. The outbreak of war makes it necessary of course to postpone for the present any efforts in this direction. We must wait. It has been indicated above how the General Committee propose raising the necessary funds, namely, on the pound for pound principle; the Governments concerned to be asked to subscribe a sum equal to that subscribed by the public. This principle involves the initiative being taken by the public and if we expect and hope, as presumably we do, that the College will come to Ceylon, the initiative in raising subscriptions will have to be taken by this

country. We shall have to lead the way. We have publicly stated our conviction that Ceylon occupies a leading position in Tropical Agriculture. This has been conceded. The responsibility is now on us to show that we have the courage of our conviction.

R. N. LYNE.

Colombo, 24th November, 1914.

The following resolution was then proposed by SIR CHRISTOFFEL OBEYSEKERE and seconded by SIR PONNAMBALAM ARUNACHALAM and carried unanimously. SIR PONNAMBALAM stated that it was a great pity that the scheme for a College should be deferred, now being the time when we should be preparing to meet the great demands upon trained agriculturists that would probably follow upon the war. If such a scheme as had been projected could not be carried out we might begin in a small way and gradually grow into an Imperial College. He invited the views of the Director of Agriculture on this point.

RESOLUTION OF THANKS AND APPRECIATION.

"*Resolved that the thanks of this Board be conveyed to* SIR HENRY MCCALLUM *and other Members of the London Committee for their efforts in urging the claims of Ceylon as the site for the Imperial College of Tropical Agriculture and that its appreciation of the success with which these efforts have met and of the energy and enterprise exhibited by* MR. R. N. LYNE *in promoting the project be recorded.*"

MR. LYNE said that the alternative idea outlined by SIR PONNAMBALAM had been considered early in the year. We were soon to open a school for the training of teachers in the elementary principles of agriculture. This would be in the vernacular. The men for this work who were now being trained at Poona would be competent to teach in English also. We could thus provide for a School of Agriculture which would prepare the way for the College.

ON THE APPROPRIATION OF NITROGEN BY LEGUMES.

A. HERKE.

Throughout his experiments the author concludes that when the soil contains sufficient assimilable nitrogen the presence of nodules on the roots has no influence on the nitrogen content of lupines. When the soil is poor in nitrogen the presence of nodules increases the absolute as well as the percentage of nitrogen content of the plant. It is noted that the greater the percentage of nodules to plant, by weight, the greater is the percentage of nitrogen in the plant (with nodules removed), but when the percentage of nodules becomes large the nitrogen content of the plant does not increase by further growth of the nodules. It was also determined that the dry matter, the nodule growth, and the nitrogen content of the plant may continue to increase after the flowering stage. The percentage of nitrogen in the dry matter of the nodules varied from 5 to 7 per cent., and 57·43 per cent. of this nitrogen was soluble in water.—EXPERIMENT STATION RECORD.

SOILS AND MANURES.

MANURES FOR PADDY.

Considerable attention is being paid at Samalkota, Coimbatore and Manganallur and to a less degree at Palur to the questions connected with the manuring of paddy. It may almost be accepted now that the most suitable form in which to apply nitrogen to paddy is in organic combination whether as green manure or as cake. It is in one of these forms that nitrogen is now always applied on the farms to this crop. It is unfortunate that the wet lands at Coimbatore are so unsuited for experimental work as it requires much repetition there before results can be accepted with any certainty. But the results of five years' continuous work at Coimbatore, nine years at Samalkota and one year at Manganallur are all in substantial agreement. At Samalkota an average increased yield of 810 lb. of grain per acre per year over nine years has been obtained by applications of castor-cake *plus* superphosphate, at Manganallur an average acre increase of 630 lb. of grain has been obtained by an application of green leaf *plus* superphosphate, at Coimbatore a competent manuring with an extra dose of superphosphate has given an increased average yield per acre of 660 lb. per year over five years. The results are also in accord with chemical analyses of the soil. In all these cases also the increases in the yield of straw has been greater proportionately than the increases in the yield of grain. A careless observer using these manures might think that all the manure was going into the straw; yet these figures show that the increase of grain is decidedly appreciable. It would not be reasonable to push these figures too far as many questions connected therewith, e.g., on the financial side, on the form in which to supply phosphate, though so far all indications point to the use of superphosphate, require to be worked out. If the prices of paddy continue to rise a little more the extended use of such fertilisers should become a matter of regular business for such land and crops.

GREEN MANURING PADDY.

Considerable interest will, for some years, circle round the action of green manuring, since there are many problems connected therewith not as yet understood. Of all the essential elements which a farmer in the west buys for manurial purposes it is nitrogen which is the most expensive, but generally speaking paddy cultivated under swamp conditions utilises nitrogen presented to it in organic combination with minerals. This is most fortunate for the tropical farmer, for green leaf and green manuring are much cheaper than nitrates, etc., in fact there is no comparison, but it is also obviously more difficult to grow and manage a green manure crop than it is to distribute over a field a certain number of pounds of nitrate. Thus it was reported last year, that on the heavy delta soils at Manganallur the application of a green manure crop in the ordinary way on these fine soils had temporarily interfered with the drainage and the paddy crops had failed. MR. SAMPSON had

surmised that in this year the fields would probably show the benefit of the green manure crop they had received; consequently no further manure was given to them. The figures are so striking as to merit repetition in full.

Paddy yield per acre in pounds.

Field Number	1911-12 Treated in ordinary method prevailing in Tanjore.	1912-13 Green manure applied, crop failed.	1913-14 No further manure added.
1	1,149	205	2,251
2	1,066	164	2,332
3	1,206	253	1,963

—REPORT OF THE DEPARTMENT OF AGRICULTURE, MADRAS.

SOIL INVESTIGATIONS.

J. W. AMES & E. W. GAITHER.

The gradual loss of calcium carbonate from cultivated soil was illustrated by soils, originally of limestone formation but containing no calcium carbonate, in which the total calcium and magnesium and that soluble in fifth-normal nitric acid was greater than in soils overlying sandstone and shales. An acid soil receiving 12,000 lb. of ground limestone in 1907 contained only 2,100 lb. of calcium carbonate at the end of a 5-year rotation in 1912.

Sand, silts, and clays examined exhibited no marked difference in chemical composition, although the clays and clay loams generally contained less total silica and slightly more iron, alumina, and potassium. Calcareous soils contained less silica and more phosphorus and potassium than non-calcareous soils. Black clay loams of limestone origin contained more phosphorus and nitrogen than other soils analyzed. In most cases they contained calcium carbonate. The surface soil to a depth of 6 in. contained more phosphorus than the subsoils (6 to 36 in.) except in a few cases where the latter contained considerable calcium carbonate, and also more nitrogen and organic matter and fine particles. The total silica was generally largest in the surface soil while the silica soluble in fifth-normal nitric acid was usually greater in the subsoil. The total iron, alumina, and potassium were greater in the subsoil than in the surface soil. Soils containing no calcium carbonate contained more calcium and less magnesium in the surface than in the subsoil. Soils containing calcium carbonate contained more of both calcium and magnesium in the subsoil than in the surface soil, the calcium being in excess of the magnesium. Non-calcareous soils always contained more magnesium than calcium in the subsoil and generally more in the soil as a whole. All the soils examined contained more calcium than magnesium soluble in fifth-normal nitric acid.

The litmus paper test proved satisfactory as a qualitative test for the presence or absence of natural calcium carbonate in soils. "Of 126 surface soils examined for calcium carbonate and reaction, only five of those containing calcium carbonate redenned blue litmus paper. All the soils which gave an alkaline reaction with red litmus cotained calcium carbonate.

"The total phosphorus content of the soils studied from 0·3 per cent., or 6,000 lb., per acre to 0·025 per cent., or 500 lb., of phosphorus per acre in 6 in. of soil." Fourteen showed the presence of more than 0·1 per cent. of total phosphorus. Soils containing calcium carbonate showed a larger supply of total phosphorus than the non-calcareous soils. The average phosphorus content of calcareous surface soils was 1,310 lb. per acre, compared with 913 lb. and 686 lb. for the non-calcareous soils from the eastern and western sections of the States.—EXPERIMENT STATION RECORD.

GREEN MANURES.

M. KELWAY BAMBER.

Rothia trifoliata.

Notes on a small leguminous plant *Rothia trifoliata* growing on the sandy coconut soils near Marawila, sent by MR. GRAHAM PANDITTESEKERA.

The plant has a branching leafy habit and grows to a height of 6 in. by 8 in. The rootlets show a small nodular development.

Composition.

Moisture	...	70·50 %
Organic matter	...	22·72 ,,
Ash	..	6·78 ,,
		100·00

Containing nitrogen 0·77 %
Equal to nitrogen on the sun dry plant 2·62 %

Composition of Ash.

Lime	...	9·70 %
Magnesia	...	8·93 ,,
Potash	...	23·26 ,,
Phosphoric acid	...	14·84 ,,
Sulphuric acid	...	3·70 ,,
Silica	...	26·15 ,,
Undetermined	...	13·42 ,,
		100·00

The ash is rich in potash and phosphoric acid, and like several plants growing in these siliceous sands it also contains a large proportion of silica. The proportion of nitrogen is similar to most leguminous plants.

The low habit of growth makes it suitable as a green manure which could be easily dug or ploughed in, but the bulk of organic material afforded would not be very heavy per acre.

RHYNCOSIA CANA.

Rhyncosia cana is a leafy leguminous plant similar to the *Tephrosias*, and having a few nodules on the roots.

Physical Composition.

Leaves	...	268 grams	...	50·0 %
Stalks	...	211 ,,	...	39·5 ,,
Roots	...	57 ,,	...	10·5 ,,
		536 grams		100·0

The proportion of nitrogen on the dry plant is 1·63 % which is poorer than most leguminous plants such as the Tephrosias. It also contains 3·60 % of ash.

Composition of Ash.

Lime	...	19·00 %
Magnesia	...	11·07 ,,
Potash	...	19·17 ,,
Chlorine	...	13·44 ,,
Phosphoric acid	...	6·24 ,,
Sulphuric acid	...	0·57 ,,
Silica	...	20·76 ,,
Carbon dioxide and undetermined	...	9·75 ,,
		100·00

This ash is rich in lime and potash, and contains a large proportion of chlorine and silica.

TEFF.

The teff hay grass gave a second crop of seed of 33 lb. from one-hundredth of an acre; this is a good crop. For the first cutting, it took six weeks to mature from sowing, yielding 115 lb. green fodder equal to 5 tons 2 cwt. per acre, or 1 ton 9 cwt. of hay per acre. That is nearly 3 tons per crop after the seed has been taken. It will only stand two cuttings.—PROGRESS REPORT, PERADENIYA E. S.

ENTOMOLOGY.

SOME MINOR PESTS OF TEA RECENTLY REPORTED.

Euproctis sp. probably *atomaria*, Wlk. The attack took place in May at Peradeniya. The caterpillar is slightly more than $\frac{2}{3}$ in. in length. The body is covered with long, tufted, white hair. The head and prothorax are reddish-brown the rest of the body greyish-brown. The prothorax bears a pair of lateral tubercles. On abdominal segments one to eight occur circular tufts of black hair with included tufts of white hair; four on segments one to six, two on seven and one on eight. In some cases these tufts are developed only on the first, second and eighth segments. The sixth and seventh abdominal segments bear each a dorsal gland. There is a yellow, supra-spiracular, longitudinal band, while ventrad of each spiracle is a prominent tubercle. The venter is greenish-yellow. In side view the abdomen rises above the level of the thorax. The hooks of the prolegs are in a curved, longitudinal band in a single series. When feeding the caterpillars spin a slight web. Many of the caterpillars were distended in the thoracic and anterior abdominal region and contained a pinkish-white grub, the larva of an Ichneumonid parasite, the adult of which has black head and thorax, and reddish-brown abdomen and legs. Moths emerged towards the end of the month. They resemble MOORE'S figure of *Artaxa apicalis* (*Euproctis atomaria*, Wlk.) but the larva does not agree with his figure of that of that insect.

Aslycus immunis, Wlk. This small weevil was reported in May from Uda Pussellawa where it was eating the young shoots that were just then sprouting from stumps. We have records of insects of this genus attacking young tea plants from Haputale and Haldumulla, while WATT AND MANN refer to others as attacking tea in Assam. Individuals of *Astycus immunis* are light to dark-green in colour and about $\frac{1}{5}$ in. in length. The smaller ones have a distinct longitudinal bright green band on each elytron. The correspondent reported that in June none were to be seen.

The insects referred to above should be collected, or, when that is out of the question owing to their numbers, the plants should receive an arsenical spray.

Callicratides rama, Kirby, CAPSIDAE. This sucking insect was received at the beginning of August from Nawalapitiya with the report that they were causing brown spots on the young flush, which ultimatety shrivelled. I have seen the same insect in small numbers on tea at Peradeniya, and it has been reported from Udagama and Morowak Korale. GREEN has collected the insect from cotton. The insect is a rather pretty one, being olive-green and crimson in colour and with transparent wing-covers. It is about $\frac{3}{8}$ in. long. The eggs are laid in the young shoots. The above attack was not serious and children had been put on to catch the insects. They should be provided with small hand-nets for the purpose.

Riptortus pedestris, Fab, and *R. fuscus*, Fab, COREIDAE. These insects are often to be seen frequenting tea bushes. They are easily disturbed, when they fly a short distance with a swift heavy flight. Nymphs also occur in numbers on the bushes, and I have reared them to adults on tea shoots. When feeding they prefer the young unopened leaves or the veins of more mature leaves. During the heat of the day they seek a shady situation within the bush. As they do not feed in colonies no specific injury to the bush is apparent. The adults are brownish insects about $\frac{5}{8}$ in. long. The hind legs are long with the femora stout and spiny. The thorax of *R. pedestris* bears four, conspicuous, round, yellow spots on each side. The nymphs are of a dark brown colour and are stouter than the adults. FLETCHER records *R. pedestris* as a minor pest of wheat and pulses in South India, and in Ceylon *Riptortus linearis*, Fab. has been taken on the foliage of seedling Hevea.

Thrips, probably *Heliothrips sp.*

These small, somewhat sluggish insects feed in colonies on both sides, but principally on the lower side, of the older leaves. The feeding areas are pale-green in colour and spotted with black excrement. The adult is black except the tip of the abdomen which is reddish-brown, and the antennæ, legs and wings which are whitish. The distal portion of segment six of the antennæ is dark-brown. The mesothorax bears a distinct rounded projection at the anterior lateral angle.

The young nymphs are green and some shew a black longitudinal band on the dorsum of the abdomen caused by the food of the alimentary canal shewing through. They carry a blob of excrement on the upturned abdomen, What is probably the same species of thrips occurs on a variety of plants including Avocado Pear and *Litsea zeylanica*. It does not seem to become numerous enough to cause much harm. Just why this is so—for in many other parts of the world thrips are very injurious insects—is not apparent. [I have recently observed that another thrips, probably also *Heliothrips* sp., which frequents in large numbers the lower surface of the leaves of *Careya arborea*, the Patana oak, at Peradeniya, is heavily parasitised by a very small chalcid with black head and thorax and light yellowish abdomen. The pupæ, which are of a black colour, occur on the leaves in thrips-like groups. It is the nymphs that seem to be liable to be parasitised.] It should not be neglected, however, colonies being destroyed whenever found. Pulling the leaves and dipping them at once into water bearing a layer of kerosene will kill the insects. In a bad case of attack by thrips the plants should be sprayed with kerosene emulsion or with a tobacco decoction, making sure that the insects are hit. Other species of thrips appear periodically on the tea in large numbers, but I have not observed any specific injury caused by them. The commonest one is a very active, light-brown insect bearing several dusky transverse bands.

Coccus hesperidum, L. (The Soft Brown Scale). COCCIDAE. This insect was received in February from Nawalapitiya. They occurred on the upper surfaces of the leaves and had been mistaken for egg-masses. The attack did not seem to have been a bad one.

Saissetia hemispherica, Targ. "Brown Bug" or "Hemispherical Scale." Twigs very badly attacked by this scale were received in June from Nuwara Eliya. The leaves were covered with "sooty mould," which represents a fungus growing on the sugary anal secretion of the Coccid. Leaves are often found to be covered with "sooty mould" and yet no scale insects are present on them. In such cases it will usually be found that Coccids, or allied insects, are located higher up on the plant, the secretion having dripped on to the leaves below. The correspondent remarked, "The blight has lately made its appearance in one of the young clearings. It is noticeable in some of the older clearings also and the stems of the affected bushes are absolutely black." The worst colonies of the bug should be cut out—and this applies to scale insects in general and the remainder sprayed with Kerosene Emulsion, especially when the crawling young are about. This treatment will also clear the leaves of the sooty mould.

Tea bushes suffering from a very bad attack from scale-insects were received in June from Lindula. The "blight" had entirely covered a field of 17 acres planted on patna soil. There were present on the plants in large numbers, *Coccus viridis*, Gr. (Green Bug), *Aspidiotus camelliæ*, Sign., *Howardia biclavis*, Comst and *Lecanium* sp. probably *discrepans*, Gr. It is probable that this tea was in poor heart. The correspondent wrote that it had been regularly cultivated and forked for the past four years, but previous to that had been thoroughly neglected. Such a field, being beyond artificial treatment unless at a prohibitive cost, and being also a menace to surrounding fields, should be pruned down and the prunings burned.

Ripersia theæ n. sp. I have collected this insect on several occasions in July at Peradeniya. The insects cover the twigs after the manner of mealy-bug. On one occasion, though the white waxy secretion covered the twigs, scarcely a single coccid could be obtained. Numerous pupæ of *Spalgis epius* occurred on the leaves, and no doubt their presence accounted for the absence of the coccid. The bush looked very unthrifty. Neighbouring bushes were free from attack. No coccids have been observed on this particular bush since. On another occasion practically every insect contained an irregularly round hole in the dorsum. The insects resemble small dipterous puparia in shape, but are almost surrounded by a layer of white wax. The antennæ possess seven segments.

A sample of made tea infested by a small beetle, probably *Lasioderma testacea*, was received in February. Such tea should be treated with Carbon bisulphide. (Vide *T.A.* Decr. 1913)

A. RUTHERFORD

CO-OPERATION.

CATTLE INSURANCE.

N. WICKRAMARATNE.

(Paper read at the Meeting of the Ceylon Agricultural Society on 24th November, 1914.)

One of the greatest assets of the paddy cultivator is his cattle. They help him to plough his fields, thrash his crop and transport his produce, in addition to supplying manure for his land and food for his family in the form of milk, butter or ghee.

But for Agricultural purposes cattle must be strong and healthy and available in sufficient numbers.

Speaking generally, very little attention has been paid in Ceylon to the improvement of cattle, and their number and quality are steadily going down.

The following figures taken from the Blue Book will speak for themselves :—

In 1907 there were 41,305 buffaloes and 67,845 black cattle in the Hambantota District.

In 1913 the numbers were 12,688 and 58,043 respectively. This means a decrease of 28,617 buffaloes and 9,802 black cattle.

In 1907 there were 57,111 buffaloes and 64,328 black cattle in the Batticaloa District.

In 1913, the numbers were 16,738 and 51,262 respectively. This means a decrease of 40,373 buffaloes and 13,066 black cattle.

Hambantota and Batticaloa are two districts in which paddy cultivation is very extensively carried on and the decrease of the number of cattle is a most serious matter to the cultivator.

Taking the figures of the whole Island, the number of buffaloes in 1907 was 550,473 and in 1913, 458,661—a decrease of 91,812.

In the case of black cattle, though there appears to be an increase for the whole Island, the figures for the more important paddy districts show a decrease. Taking the Colombo district we find an increase of 23,793 for the seven years, but if we omit Colombo we find a decrease of 6,663 for the rest of the Island. The inference is obvious, viz.—that the increase shown for the Colombo district does not represent agricultural cattle but animals imported chiefly for slaughter and draft purposes.

It is therefore clear that so far from there being an increase of local stock by natural reproduction there is a steady decrease ; and if this decrease is permitted to go on unchecked and no steps taken to provide for increase of number and raising of standard in quality of rural cattle, native agriculture is bound to suffer while the prospects of improving the system of tillage in vogue by the employment of better types of implements is of the gloomiest.

It may be said that machinery should take the place of animal traction, but the conditions under which paddy cultivation is being carried on in the Island do not favour the use of machinery and the cultivator must continue to depend upon cattle for nearly all his field operations.

There are some who are of opinion that the laxity shown with regard to paddy cultivation is solely due to the abolition of the paddy tax, but the fact is that before the abolition there were facilities for carrying on the work which do not now exist. Then there was an ample supply of cattle and pasture, while the direct interest which Government had in paddy land acted as an incentive to cultivation. On the other hand there is at present greater security as regards land tenure in that there is no danger of fields being sequestered or sold for non-payment of tax. And yet difficulties that have since arisen are acting as a severe check on both extension and improvement of cultivation. The chief difficulties are the loss of large numbers through epizootic diseases such as rinderpest, the want of adequate pasture land, the absence of any organization for improving the breed of cattle which has degenerated owing to in-breeding.

It may truly be said that cattle are as essential to native agriculture as Tamil labour is to the planting industry. It is therefore necessary that steps should be taken to arrest the depletion of agricultural stock that is going on apace and make every effort to increase their number and improve their standard.

We hear of measures being adopted in other countries for the conservation of farm stock, and much has been done in this direction by means of a system of Co-operative or Mutual Cattle Insurance.

It is not possible in a short paper such as this to go into the details of this system, but I would commend it to the serious attention of all owners of live stock. In England and some of the Continental States it has been taken up in earnest and has proved of the greatest utility ; while India has also followed the example set. From recent reports it is gathered that there were 54 Cattle Insurance Societies in Burma in 1913, run on the lines of those found in Belgium and France. These Societies have a membership of 1,032 persons, and 2,050 cattle insured for Rs. 75,454. The premium receipts for the year 1913 were Rs. 2,378, which with Rs. 974 brought forward from the previous year made a total of Rs. 3,352. The amount of indemnities paid was Rs. 187 on eight animals. These figures are merely given as an example of the working of societies which exist not very far from us.

MR. A. E. ENGLISH, I.C.S., Registrar of Co-operative Credit Societies in Burma, states the object of this Cattle Insurance movement in the following words :—

"The basic principle of Insurance is the yearly payment in advance by a number of owners to a Society of a sum calculated at least to equal the yearly average amount of loss sustained in respect of the things insured, from which sum the Society contracts to pay indemnities to the losers.

"The sum paid by an owner to the Society is called a premium and it is calculated at a settled proportion of the value of the property insured. The roportion payable as premium is big or small according as the risk,

that is the yearly average loss, in the property insured is large or small. Thus the premium payable in respect of a masonry house is very much less than that on a wooden house. In respect of some property the risk is so great that no society would agree to accept it in insurance at a rate of premium that any sensible man would pay. Thus the premium on a mat and thatch house would probably be so high that no one would insure it.

At first sight it would seem that as *Insurance* business implies a large area and many insurers it conflicts with the principle of *Mutuality* which is best attained in a restricted area, such as a single village, and with a limited number of persons insuring. And indeed there is such a conflict, but it is got over by what may be called the storey organization, by which the *Mutuality* principle is attained by forming in the first case village Societies, and the principle of large area and large clientele is arrived at the village Societies insuring again in a Central Society which takes a half or a quarter of the premium and pays a half or a quarter of the indemnities.

"The advantages gained by circumscribing the area of the village society are *proximity* of the Society to the insurer and mutual supervision. Cattle can be valued, inspected and deaths enquired into at once and on the spot, and fraud is rendered almost impossible as the remaining members in the village know the cattle, how they are tended, and why they die.

"Again there are educational advantages in that where the whole society is concerned in the treatment of every insured beast, public opinion is formed to bear in favour of more sanitary and more careful tending, and in favour of careful measures to avoid or combat epidemics. Further, the members help each other and work together to provide against future difficulties and to obtain a general improvement in the condition of the cattle. The village as a whole learns self-reliance."

Aiming as these Societies do at securing an adequate supply of village cattle, of improving their breed, conserving their health and providing facilities for maintaining their numerical strength, it may be expected that the local application will prove of the greatest value to us in view of the present situation and tendency, and it appears desirable that the matter should be carefully gone into and some definite action taken.

Information as to details of the system may be obtained from the office of the Registrar of Co-operative Credit Societies, Peradeniya.

AGRICULTURAL CO-OPERATION IN AUSTRALIA.

In an interesting contribution to the journal of the Department of Agriculture of Victoria, MR. J. P. J. CARROLL describes the development of Agricultural Co-operative movement in the State of Victoria in the Commonwealth.

In New South Wales, Victoria, and South Australia particularly, and, to a lesser degree in Queensland, Western Australia, and Tasmania the conduct of business on the co-operative system has yielded the most beneficial results

to those concerned, and there are on record several instances where the efforts of individual co-operative societies to promote the welfare of their members have been attended with conspicuous success.

About the year 1888 before the movement gained ground in the State the production in Victoria has exceeded the local demand, and prices fell so low that the occupation of farming failed to provide an ample return to the tillers of the soil. Cereals, root crops, and dairy produce were selling at ruinous prices and insolvency was staring producers in the face.

This led to the appointment of a Royal Commission called the "Vegetable Product Commission," the recommendations of this Commission induced the Government of the day to offer financial assistance towards the development of the trade which led to the organisation of co-operative societies throughout the State.

The first society was organised with the purpose of building and equipping factories for the manufacture of butter, and in the year 1888 a very primitive factory was established. The Society made splendid progress and now it possesses a modern and magnificently equipped factory.

In the year 1891 the sum of £2,235 was paid for milk and in 1899, £26,816 was distributed among suppliers. In 1913 the total amount disbursed was £58,347. During the past twenty-two years of the Society's existence, the sum of £817,659 has been paid for milk and cream and a further distribution of £32,627 has been written off for depreciation. The value of land, plant and machinery is set down at £7,645.

This Society has now erected several creamery or separating houses and a cheese factory in a most accessible locality for the convenience of producers. In the course of time several other Societies were established and the business of these Societies were extended not only for buying supplies but also for selling stores. There are now in the State nearly 100 co-operative butter factories representing a very large capital producing about 70 per cent of the butter produced in the State.

The co-operative principle extended to other products as well; poultry raising being one of them. The factories were used as depots for the collection of eggs which were collected daily and despatched to the market in a condition that enabled the producers to obtain top market rates and dispense with services of the costly middlemen. The co-operative spirit seems to be gradually extending, more particularly in the backward or less populous parts of the State. A movement was begun about the middle of the year 1900, amongst a number of co-operative butter factories to form a Central Association federalizing the Co-operative Societies for purpose of distribution of produce of the factories and undertaking all the duties previously carried out by private agents.

The Victoria Butter Factories Co-operative Company, Limited, was the first purely co-operative distributing society in Australia. This society claimed to have made enormous savings in the cost of marketing the produce, and that the shareholders are enabled to obtain legitimate prices for their output. It was started with a paid-up capital of £1,490 and has now a paid-up capital of £8,000 and a reserve fund of £4,500; and has extended its functions to the manufacture of butter boxes and the business of freezing on which a sum of £17,000 has been invested.

In 1904 an impetus was given to the further extension of the principle of federating the co-operative societies and a company was formed to buy, sell, export and distribute all kinds of dairy produce ; poultry, eggs, honey, and any farm, dairy and garden produce ; to purchase, manufacture and sell all farm and dairy requisites, including implements and machinery and this company is making very satisfactory progress.

Further development is noticed in the direction of organising societies by farmers for the purpose of making savings in the cost of distribution of other products, hay, chaff, etc., and for the purchase of bran, pollard seed, etc.

The first and most successful of these Societies is Korvit and Tower Hill Farmer's Co-operative Society, Limited.

The capital of the Society is £1,200 consisting of 1,200 £1 shares. There are 260 shareholders, 80 per cent. of whom are directly engaged in farming pursuits.

During the five years of the Society's existence it has earned a profit of £3,146. Similar Societies are in operation in various parts of the State and many more are in course of formation.

The next step taken by the movement was to create similar organisations amongst the fruit growers.

Very many Societies have been organised in this direction which are doing considerable business in the manufacture and exports of various products with great savings to those concerned. Mr. Carroll reminds that the grading, improvements and standardising of products are amongst the most important functions that could be undertaken by these Co-operative Societies, and if their efforts went no further than this the results would more than justify their formation. He fears that this phase of co-operation is too often subordinated to the commercial side of the business, and instead of encouraging the production of superior quality the reverse is the case.

The "Pig Industry," "State Aids to Co-operation" and "Fruit Cool Stores" are other subjects which have been dealt with in the article which contains a mass of information of very instructive nature to those who are interested in the co-operative movement.

N. W.

SOYA BEAN CAKE AND MEAL.

Soya bean cake is made from the bean of a leguminous plant *(Soya hispida)*. This bean has long been extensively grown in the East, where it forms an important article of human food, but only since 1908 has it been imported in quantity into this country. It differs from the common field bean in being rich in oil. To a small extent the soya bean itself is used as a cattle food, but, as a rule, the greater part of the oil is first removed by seed crushers, the residual cake or meal being used for feeding purposes. In the ordinary course the oil is removed by heat and pressure, the residue being in the form of a cake which still contains a considerable percentage of oil. A soya bean meal, however, is also sold, and from this nearly the whole of the oil has been extracted by means of a chemical solvent.

Soya bean cake usually contains 40-45 per cent. of albuminoids and 6-8 per cent. of oil. It therefore approaches decorticated cotton cake in composition and should be fed in the same way in moderate quantities along with starchy foods, such as the ordinary cereals and their offals, and with roots, hay and straw. "Extracted" meal is much poorer in oil than the cake, containing only about 2 per cent., but it is correspondingly richer in albuminoids. It should be fed in moderate quantities along with other less concentrated foods. Soya bean cake and meal have a high manurial value, similar to that of decorticated cotton cake, and considerably higher than that of linseed cake.—Journal of the Board of Agriculture.

GENERAL.

THE SWEET POTATO.

(*Illustrated, see frontispiece*).

A NEGLECTED FOOD CROP.

It is rather remarkable that a vegetable of such importance as the Sweet-potato should be so much neglected in Ceylon, as it seems to have been at any rate up to the present. Though a favourite and standard article of food in other countries, being commonly grown in tropical as well as in sub-tropical regions, its cultivation here has so far been manifestly limited, and practically confined to the gardens of coolies for the latter's own consumption. This is all the more noticeable when it is considered the ease with which the plants can be grown, the comparatively short period required for producing a crop, and the nutritious and tasty qualities of the tubers. Had it been less known, and required greater skill in its cultivation, it would probably command greater appreciation of its worth.

Thus the Sweet-potato furnishes in some respects a further proof of the saying that a prophet is not honoured in his own country. This recalls to mind an incident of the last great famine in India, when a search was made for quick-growing food crops. Among others proposed was the Sweet-potato, but apparently nothing so common could be considered as of any use, and so it was decided to introduce carrots for the starving natives. This was promptly followed by the memorable cable order for 100 tons of carrot seed to an English firm, which, be it said, was executed with promptitude—a feat which to many people might seem impossible. But when the crops, or such of them as grew and matured, were harvested it was found that the people had not developed the necessary acquired taste for carrots, which in the end were fed to horses and cattle.

The reason why the Sweet-potato is not more in the fashion as a table vegetable in Ceylon is doubtless due not to prejudice so much as to indifference, there being no special need for it, so long as there is enough rice and curry-stuffs available. "Needs must" is a common doctrine to be applied in Ceylon as elsewhere in the East, and it is difficult to convince the peasants of the desirability of making provision for a possible "wet day." Recently, however, as a result of the propaganda of the Department of Agriculture and the Agricultural Society to stimulate the cultivation of quick-growing food crops, especially among the poorer classes who might be the principal sufferers in the event of a shortage of imported food supplies, a noticeable impetus has been given to the cultivation of Sweet-potatoes. The accompanying illustrations show a well-cultivated field in the Kandy district and a specimen of the tubers grown. There must be a large number of similar fields in other parts of the Island, judging by the great number of applications for plants or stock that have recently been received and supplied by the Society.

The native habitat of the Sweet-potato is, like that of many other crops long cultivated, lost in antiquity, but it is clearly indigenous to the tropics. It has been supposed to have come originally from S. America, but there appears to be evidence showing it to be also indigenous in Asia; in any case, it is nowhere found in a purely wild state. It is adapted to a wide range of climate, and its cultivation extends to all tropical and warm countries, being largely carried on in the Southern United States, China, Japan, many parts of Africa, etc. It has long been the principal article of food of the natives of some of the Pacific islands and Northern New Zealand, where it is still extensively cultivated. It was known in England as far back as 1597, when it was grown during the summer months in a London garden. It is grown somewhat largely in the Canaries, Spain and Southern Europe, whence small supplies sometimes come to London. In Ceylon it can be

grown successfully from sea level to about 4,500 feet elevation, but in the dry regions will require irrigation. A rather dry than wet climate suits it best.

To those who are interested in the botany of the plant it may be mentioned that it belongs to the Convolvulus family (*Convolvulaceæ*), being thus a close relative of the Jalap plant and other poisonous species. In this respect it is analogous to the common potato, which though a wholesome vegetable belongs to the Natural Order *Solanaceæ*, a notorious family which includes the "Deadly Night-shade," Datura, Tobacco, and other doubtful characters. For some time botanists placed the Sweet-potato in a genus by itself and called it *Batatas*, merely adopting the Spanish name for the plant. From this it became to be called potato, or rather Sweet-potato, by the English. The plant was subsequently placed in the genus *Ipomœa*, and is now universally known as *Ipomœa batatas*. As is well known, the family is distinguished by creeping or twining herbaceous or woody plants, with bell-shaped flowers. The Sweet-potato has long been known to the Sinhalese as "Batala" and to the Tamils as "Vel-kelengu," which simply means "climbing yam." To the Maoris of New Zealand it is known as "Kumara."

The propagation and cultivation of the plant are most simple. The ground being prepared by deep and thorough trenching or ploughing and cross-ploughing, cuttings of matured stems or sections of the tubers are planted at distances of about a foot apart. If cuttings, they should be watered for a few days if the weather be dry. The plant, being a creeper, readily roots at the nodes, so that cuttings strike very easily. Well-drained sloping land, with a light friable soil is the best. The soil should be thrown up in ridges or raised beds, leaving a furrow between these for convenience of working. The young plants will soon cover the ground, but should be gone over occasionally to prevent them rooting at the nodes, for otherwise small tubers of no value will be produced at the latter and this will of course adversely affect the growth of the tubers at the main root. Except perhaps in virgin or rich soil, manuring is essential. Any natural manure will do, but in the absence of this a mixture of chemical fertilisers may be applied with excellent results. A mixture containing ammonia, potash and phosphoric acid is commonly applied in the United States, at the rate of about 2 oz. per square yard.

A crop may, under favourable circumstances, be obtained in from three to four months from planting. In harvesting, the vines should be cut before digging up the tubers, and what are not used for replanting should be buried in the ground. A yield of about 250 to 300 bushels per acre is considered a fair average yield when cultivated systematically. According to SIR GEORGE WATT a return of about six tons per acre may generally be obtained in India. It is best, of course, to plant the crop in rotation with other crops. It has been found that if planted after a leguminous crop the yield is greatly increased. As a catch-crop or ground-cover the plant seems well-adapted, and on areas where weeds cannot be kept under control by manual labour, the planting of Sweet-potatoes would effectually answer the purpose and at the same time provide an article of wholesome food.

As in the common potato there are a great number of varieties, these varying in size and shape of leaves and tubers. Both tubers and leaves are red or purplish in some varieties. In some again the leaves are entire and heart-shaped, in others palmate. The different varieties are given different local names in some countries, as in America, the West Indies, etc. Some varieties produce only one enormous tuber, while others are characterised by a number of smaller tubers produced in a cluster around the main root. Tubers of a medium size are generally the best for eating. Sweet-potatoes have, as is well known, an agreeable sweetish taste. They contain more sugary and starchy matter than the common potato, but rather less nitrogenous substance. Recently it has been grown in some parts of the world, especially in the Azores, as a source of sugar, and is said to be an excellent source of spirit, 225 lb. of tubers yielding about ten quarts of absolute alcohol.

H. F. MACMILLAN.

THE CEYLON PEASANTRY.

R. CHELVADURAI-PROCTOR.

(Continued from p. 238).

My object in discussing the merits of the system of *metayer* cultivation in Ceylon is to invite the attention of local men of capital and education to it. It is an ancient system in Ceylon which has grown and developed, like a plant, without extraneous aid of legislation or compulsion. Its root is firmly struck into the social organisation of the people and its branches afford shelter to many a family that had been rendered landless. A metayer cultivator may start life without a cent in his pocket; with nothing except his own ability and that of his family to work. Slowly he acquires property in cattle by receiving "wages" in kind for tending his landlord's cattle, a boy of his, or his wife, earning this wage. Soon he becomes owner of agricultural implements. He saves paddy from his metayer share to supply his own seed at the next sowing, and thus becomes entitled to draw the customary "share" for the contribution of seed. He uses his own cattle for ploughing and transport and receives the customary hire. The landlord considers him more or less as his apprentice, and when the time comes for the metayer tenant to leave his landlord, having saved sufficient means to set himself up as an independent farmer, he is helped to it by the landlord. Like a son who leaves his parental home to build up a new one for himself, so does the metayer tenant leave his former landlord, receiving his blessing. This is the old method of communal expansion. It is a common thing in our own experience to see families once rich becoming poor. Among the peasantry poverty carries no social stigma. All possible assistance is given by the community to rehabilitate the fallen. And thus it is that the supply of metayer cultivators come.

Closely involved in the metayer system of cultivaton is the subject of land tenure which explains the system. Under the native kings all lands in the realm belonged to the State. Subjects were allowed to occupy as much land as they could cultivate. The formation of a village was not to be done in a haphazard manner, but should follow the order and method laid down in the *Shastras* and enshrined in custom. The king received rents from the occupied portions of his land. It was in his power to make absolute gifts in land to families and communities, in which case no rents were leviable. Some lands were burdened with obligation of personal service. But property in land in every case carried with it certain duties, responsibilities, rights and also immunities. These varied according to places, circumstances and status of the occupiers. Property of which the owner or owners failed to render obligations escheated to the State. The system of native government on arrival of the Portuguese was found to be carried on on the following lines :—"The land was divided into certain portions, each of which was appropriated to realisation of one particular object of Government, whether of Religion, Finance, Justice and Defence. Personal service, variously modified according to their approximation, then constituted the tenure upon which land was occupied and upon failure of that service the king reassumed possession. No individual was therefore taxed but in the object of his possession. The soldier and civilian in their respective services, the cultivation of land in its produce, the workman in his merchandise and the daily labourer in certain portions of his labour."

It would appear that the metayer tenant could hold lands from any of the following landlords: the church, the king, the soldier, the civilian and the peasant, and none of these could raise the "rent" arbitrarily. The church afforded sanctuaries against oppression. High lands on which the metayer lived were absolutely his own. He was not to pay rent on them to any one.

The village is not merely a geographical unit. It is also a *social*, an *ecclesiastical*, and a *civil* unit enjoying some measure of self-government. Those who live in it are bound by its customs and usages. And customs and usages of the village are not like the laws of the Medes and Persians. The village council—I use the expression in the sense that it is understood by the villagers, viz: the Council of Elders—can change them to suit changing conditions. The metayer tenant, as also the landlord, is amenable to the order of the 'Council'; neither of them can act unfairly to the other without exposing himself to ecclesiastical, social and even civil punishment. It is the social punishment that is most dreaded.

The chief industry of the village is the cultivation of paddy and raising other food products. Other industries are subsidiary to it. It is the time-honoured belief that producers of corn stand high in the social scale. Duties (Marma) of those who stand high are settled on the principle of *noblesse oblige*. The agriculturists are enjoined to practise the following virtues—10 in number—which should distinguish them from the rest and constitute the essence of their being. They are 1. Keeping an oath (2) Raising up the fallen (3) Being obliging (4) Having compassion (5) Supporting relations (6) Perseverance (7) Paying taxes (8) Being peaceable (9) Hospitality (10) Correct or refined conduct. The family sense in the individual is a strong motive of conduct in the peasant. Not only is that sense induced by the race culture which he had inherited, but also by the numerous checks which various institutions (of course, they are ancient ones) have placed to ensure his "correct conduct." Thus it comes to be that in spite of exploitation, injury and poverty the villager is still honest, kind, sympathetic and obliging. Thus also is explained the character of the poor Indian cooly who boldly undertakes to pay the debts of his deceased parents and would make great sacrifices to fulfil his undertaking. In the whole Island I do not think there can be a single villager who will not willingly contribute to defray the expenses of visit and reception of a great personage who goes to his village in the name of culture.

A feature in the paddy cultivation is the communal interests and co-operative spirit that it fosters. In the forming and repairing of village tanks and channels, in putting up fences, in watching the crop and in several other details of work connected with the industry, co-operation of the whole village community is required. Call this co-operation, or use the less objectionable word combination, the fact remains that the community through this means acquires co-partnership interests. An industry is said to be carried on upon the co-operative principle "when the employers and the employed are merged into one, and when the capital which is needed for the production and distribution of wealth is supplied by those who provide the requisite labour." In the light of this definition, the village community is a co-operative association.

That villagers were not isolated units, but that, even before the British Government opened roads and railways, they had enjoyed some facilities of communication is evident. The late MR. WITHERS while holding the appointment of Assistant Government Agent, Mullaitivu observed: "It is interesting to observe how the seats of the chief temples are still the Emporiums of Commerce at the festival seasons when inhabitants of the most distant villages congregate to pray and to purchase." The great festivals of

the Sinhalese and Tamils suggest the existence of an industrial and political federation of the village units from remote times. The festivals, which are national, express the paramountcy of the paddy cultivating community in the State.

(1) Avurudu Mangalla (the Hindu New Year) festival is celebrated soon after the Maha harvest. It was both a thanksgiving worship and a political pageant. At this festival the king used to receive a certain portion of his revenue and to confer new appointments.

(2) In August, just before the sowing, comes the Perahera festival. The people congregate to worship, to discuss industrial questions, to sell and to purchase. *Usufructuary* mortgages are discharged during this time.

(3) Karthiya Mangalla (Velakkedu) festival in November is celebrated by a general illumination for one night. This marks the rejoicing over the earing of paddy crop.

(4) Alutsal Mangalla (Puther) festival celebrated the bringing of new rice to the homes of landlords and farmers on an auspicious day. After this festival commences the reaping.

The old institution of the peasantry are still intact. I am not one who seeks for the golden age in the past, but I feel convinced that the past has lessons to teach us. If we can build on our past history and traditions the saving, moral and economic, to the community will be great. Nor can it be said that modern education is so barren of resources that it cannot adapt the past, taking in all that is good and useful and rejecting all that is effete and worthless of the past, to suit the requirements of our new conditions and environments. Thus alone can new life be given to the industry and the people. Formerly there was a privileged class, the brahmans and the priests, particularly, who applied themselves to study the wants of the people whom they directed to safe course. Now the duty has fallen on the educated class. If the condition of the peasantry is to improve, it must be through their influence. The danger of a growing proletariat class should be minimised. The Kandyans carried on war for over 300 years with three European powers in succe sion, without incurring a national debt and without serious economic distress among the people. If there had been a proletariat class among them depending on cooly hire for maintenance the state of things would have been different. Accumulation of wealth in the hands of a few is not desired. The *Ande* (Metayer) system of cultivation, invested as it is with traditional dignity, and possessing as it does the advantage of its principle being well understood by the people, I trust will, if availed of by capital, serve as the means of bringing many landless people back to the land. Capital will find investment on paddy fields on this condition of cultivation highly profitable.

If in a commercial country like England where competition has superseded custom, where each individual is free to seek his own gain, unfettered by caste considerations or family traditions, according to the way he thinks the best and where labour is in constant conflict with capital, withal mobile, the metayer system, which depends for its success on the mutual regard and trust, cannot be a success. This cannot be any reason why the system should be abandoned in Ceylon. Race culture, moral and physic influences here are different; so are also climatic conditions, standard of living, social and civic outlook. In some parts of the Continent of Europe, the metayer system obtains. There it is merely an economic arrangement between the landlord and the tenant, the former agreeing to pay the latter a share of the produce in lieu of rent. There at best the position of the tenant is precarious. No safeguards are provided there, such as exist here, to secure the

tenant fairplay. The tenant lives on the landlord's land which he tills. No fixity of tenure is assured and he often suffers loss through competition. Yet learned men who studied the subject of metayer tenancy in the Continent of Europe in all its aspects speak of it in terms of unstinted praise.

THE RIGHT HONOURABLE HENRY FAWCETT in his *Manual of Political Economy* says :—"If we wish fairly to compare the condition of an agricultural population in a metayer country with its condition under a different system of land tenure, we ought to contrast the metayer country not with capitalist farmers but with agricultural labourers, working for hire. If this comparison is made, there certainly can be no doubt that the metayers of Italy in their social and economic condition are in every respect greatly superior to our own agricultural labourers.

CHATEAUVIEUX states: "The metayer system constantly occupies and interests the proprietors which is never the case with great proprietors, who lease their estates at fixed rents. It establishes a community of interests, and relations of kindness between the proprietors and the metayers—a kindness which I have often witnessed and from which results great advantages in the moral condition of society."

"SISMONDI, who was a metayer landlord, speaks in warm approval of the system. He proves by the most definite facts that under the metayer tenure the land is well cultivated, and that the condition of the metayer tenants is in every respect most satisfactory."

THE RIGHT HONOURABLE FAWCETT further states: "It must be remembered that the labour of the metayer will be, in all probability, much more efficient than that of our own agricultural labourers who simply work for hire; they have no interest in the work in which they are employed, they have no motive, but to labour with just sufficient skill and regularity to avoid being dismissed. To them it is a matter of little moment whether their employer's profits are large or small. The indolence and carelessness which are thus engendered cause a loss to an employer which is rarely adequately appreciated."

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LINSEED PRODUCTION IN INDIA.

The object being to promote flowering, not to produce long, straight, fibre-yielding stems, the seed is sown much thinner than is generally the case with European flax. The result of this special cultivation has been to develop several well marked races, all of which possess one characteristic—a much-branched stem. There are two readily recognised kinds, namely, a white-seeded and a red-seeded, and of each of these at least two grades with either "bold" or "small" forms of the seed. The latter may be only a condition of defective cultivation or immaturity of crop, but commercially the bold seed is the form of greatest value. The subject of the cultivated races of linseed is, however, too imperfectly understood to allow of more being at present said regarding them than that many distinct forms exist. It would, therefore, be the most obvious course to pursue, in any attempt at new developments of the linseed traffic, to improve the stock by careful selection in the direction desired, rather than to attempt the acclimatisation of exotic stocks. It is well known that the quality and yield of oil varies greatly in the seed of one country as compared with that of another. The white-seeded form has usually white coloured flowers, the brown-seeded blue flowers. Moreover, the white seed has thinner shell, and contains nearly two per cent. more oil than is the case with the red. These facts have led to many inquiries as to the white-seeded plant being grown separately and the seed sent into the market pure. The demand for such pure seed has never, however, been so large and constant, nor the hopes of increased price sufficiently encouraging, to tempt producers to give the attention to the subject that would be necessary. Moreover, it is said that the quality indicated is not constant. In other words, under altered conditions, the white-seeded plant may produce red seed and thus frustrate the production of a pure crop.

The linseed consumed in India represents only about five per cent. of the production, hence it is not far from correct when it is affirmed that the traffic as known to us to-day is entirely a consequence of the British administration—a gift to the agriculture of India which covers an area of land, profitably utilised, of approximately four million acres, and gives a production of half a million tons of oil-seeds, which represents a contribution to the earnings of the farmers of three and a half million pounds sterling. Moreover, it is a crop that may be used as a safety-valve, and be increased or decreased according to the owner's advantage. In other words, land is thereby profitably cultivated, in excess of ordinary food necessities, which may be thrown under food crops as occasion arises. But for these very reasons, the traffic is subject to the greatest possible variations. Production depends greatly on local necessities of food, the prices ruling in Europe for linseed, and the relative values of linseed and cotton for the time being. The Argentine Republic has within recent years become India's most formidable rival.

Linseed, like wheat, is very readily influenced by the vicissitudes of bad seasons, caused either by drought or blight. But so important a position has the Indian supply secured in the markets of the world, that when the quantity decreases the price, as a rule, rises, thus compensating the producer. But perhaps the most instructive lesson to be learned from the study of the areas of production of linseed, in relation to the returns of foreign exports, is the circumstance that while linseed holds the third position in area, the value and quantity of the seed exported from India are usually very nearly the values and quantities of all the other oil-seeds taken together. And from this standpoint alone, therefore, is derived a fairly tangible conception of the consumption of oils and oil-seeds within India itself, and full confirmation obtained of the statement already made that linseed is grown primarily for the purpose of export; it is a rent-paying crop.—WATT'S COMMERCIAL PRODUCTS OF INDIA.

EFFECT OF IRRIGATION WATER ON LAND.

A. D. HALL, M.A., F.R.S.

Closely linked up with the problems of dry-land farming are those which arise in arid climates from the use of irrigation water on land which is either impregnated with alkaline salts to begin with or develops such a condition after irrigation has been practised for some time. The history of irrigation farming is full of disappointments due to the rise of salts from the subsoil and the subsequent sterility of the land, but the conditions are fully understood, and there is no longer any excuse for the disasters which have overtaken the pioneers of irrigation in almost every country. Sterility may arise from two causes—overmuch water, which brings the water-table so close to the surface that the plants' roots may be asphyxiated, or the accumulation by evaporation of the soluble salts in the surface layer until plants refuse to grow. The annual cutting off of the cotton crop in Egypt as the water-table rises with the advance of the Nile flood affords a good example of the asphyxiation, but in the neighbourhood of irrigation canals we also find many examples of sterility due both to the high water-table and an accompanying rise of salts. The governing principle is that drainage must accompany irrigation. Even if free from salts at the outset, the land must accumulate them by the mere evaporation of natural waters, and they will rise to the surface where they exert their worst effect upon vegetation, unless from time to time there is actual washing through the soil and removal of the water charged with salt. Without drainage the greater the quantity of water used the greater the eventual damage to the soil, for thereby the subsoil water table carrying the salts is lifted nearer to the surface. With a properly designed irrigation system the danger of salting ought not to occur; there are, however, many tracts of land where the supply of water is too limited to justify an expensive scheme of irrigation channels with corresponding drainage ditches at a lower level.

Take the case of a farmer with some water from an artesian well at his disposal, with perhaps little rainfall, with land subject to alkali, and no considerable natural fall for drainage. If he merely grades the land and waters it, sterility rapidly sets in; the only possibility appears to be to take a comparatively limited area and to cut out drainage ditches or tile drains 4 or 5 ft. below the surface, even if they have to be led into a merely local hollow that can be abandoned to salt. The bed thus established must then be watered at any cost until there is a flow in the drains, after which the surface is immediately cultivated and crop sown. There should be no further application of water until the crop covers the land, the use of water must be kept to a minimum, and by the ordinary methods of dry cultivation evaporation must be allowed only through the crop, not merely to save water, but to prevent any rise of salt. With a loose surface and wind-breaks to minimise evaporation it has thus proved possible to grow valuable crops even on dangerously alkaline land. Superphosphate and sulphate of ammonia have proved to be useful fertilisers under these conditions; both tend to prevent the reaction of the soil becoming alkaline, and the calcium salts of the superphosphate minimise the injurious effects of the sodium salts that naturally accumulate in the land. On the other hand nitrate of soda is a dangerous fertiliser. Attempts have been made to reduce the salts in the land by the growth of certain crops which take up a large proportion of mineral matter, but I have not been able to ascertain that much good can be thus effected. Sugar-beet and mangolds do appreciably reduce the salt content, but are scarcely valuable enough to pay for such special cultivation and the limited irrigation water; the best thing appears to be to grow salt-bush on the non-irrigated margin of such areas, if only to prevent the efflorescent salts from blowing on to the cultivated portion.—Address to the British Association.

THE CULTIVATION AND SELECTION OF SESAMUM.

Sesamum is a seed-producing crop, the cultivation of which is worth attention in the West Indies. Experiments have been made already in Grenada, Antigua, Montserrat and St. Kitts. The commercial possibilities of the cultivation are of course not yet definitely known ; in Antigua, the principal factor which interfered with the cultivation of this crop was disease, but the appearance of a paper on the improvement of Sesamum, in the PHILIPPINE AGRICULTURIST AND FORESTER, makes it seem likely that this and any other difficulties pertaining to the plant itself can be got over by selection.

It may prove interesting before referring to the selection work, to give a brief account of the cultivation of the crop. A native most probably of North Africa, Sesamum is a plant which requires a warm climate, and although it can be grown on almost the poorest land in cultivation it does best, like most other crops, on a rich fertile one, preferably light. The methods of planting differ, but in the Philippines it has been found best to plant the seed in rows. When they are about four inches high, they may be thinned from two to four inches apart. This depends, of course, upon the variety and the cultivation. The land must be properly weeded. As regards different varieties, it is stated these can be easily recognised from one another by their leaves, capsules and the duration of time from sowing to maturity. Some are early varieties and others are late. One of the most productive varieties tested in the Philippines seems to be No. 1622-F, (White).

Several diseases of Sesamum appear on the Philippines. The most common insects are leaf rollers. There are two fungus diseases observed: the damping off fungus, and a leaf spot caused by *Cercospora Sesami*, A. Zimm. The damping off disease generally occurs in rainy weather, when the plants are crowded. It attacks only the small plants. *C. Sesami* attacks the leaves only, and eventually causes them to fall.

The harvesting of Sesamum is very easy and simple. The stem is cut close to the ground with a sickle, and the cut stems are then piled up and tied into bundles. The smaller the bundles the better will be the drying. Immediately after they are brought to the drying house, they can be spread on a mat. They are dried there till all the capsules are opened and the seeds can be shaken out. As regards market value, the figures given in the paper under consideration do not apply to the West Indies, but it may be noted that it is said three litres of the white variety seed sells at 30 to 40 centavos. The black fetches less.

With reference to the use of Sesamum seed, it is stated that two-thirds of the world's production goes to Marseilles for oil extraction largely used for making soap, in perfume, and for burning in lamps. It is also extensively used in certain places, e.g., Egypt, as a substitute for olive oil. As is well known, the residual matter or cake is employed as a cattle food, in which connection it has been observed to have a great influence upon the butter and fat of dairy cows.

Turning now to the selection experiments, it may be explained that before the harvesting of each variety, selection was first made in the field. During the selection several variations were noted : in the number of the locules, in the branching habits, and especially in regard to susceptibility to leaf spot. Space prevents a discussion here of the tables of observations, and it must suffice if we present the summary of conclusions, based upon these

figures, which the author places at the end of his article :—

(1) The yield of sesamum can be increased by selection in the field, and by growing the selected seeds in separate plots. (2) The sports which appear in 403-F, such as the hairy and the smooth forms, can easily be bred true. (3) With the character of high yielding which is found in certain plants of 403-F, can be correlated branchiness, fineness of the hair, and shape of the capsules, in all of whch they differ from the common stock. (4) The varieties of 404 and 403-F can be self-fertilized. (5) Sesamum in common cultures in the Philippines needs to be improved by selection, as regards strength of stem, immunity to disease, uniformity of type, resistance to drought, and brevity of crop period ; and above all else, as to productiveness.

—Agricultural News.

EXTENSION OF CROPPING BY DRY FARMING.

A. D. HALL, M.A., F.R.S.

Let us now consider the various methods by which land suffering from one or other of the disabilities we have just discussed is nowadays being brought into cultivation. The most important, if we consider the area affected, is the extension of cropping into regions of a deficient rainfall by means of what has been termed dry-farming. So far as its immediate methods go, dry-farming consists in nothing more than the application of the principles of husbandry worked out by English farmers in the east and south-east of England, principles first expounded by Jethro Tull, though a complete explanation was not then possible, even if it is now. In the first place, the tilth must be made both deep and fine, thus whatever rain falls will be absorbed and the conditions favouring a deep and full root range will have been established. Next, the soil below the surface, though finely worked, must be compact, because only thus can the water present travel to the roots of the plant. Lastly, a loose layer must be maintained on the surface, which, though dry itself, acts as a screen and barrier to prevent loss of water from the effective soil below by any other channel than that of the plant. Granted these methods of cultivation, the new feature about "dry-farming," which has been introduced by settlers in the arid districts of Australia and North America, is the use of a year of bare fallow in which to accumulate a supply of water for the next years' or two year's crop. This raises the fundamental question of how much water is necessary for the growth of an ordinary crop. The first investigation that Lawes and Gilbert carried out at Rothamsted dealt with this very point; they grew the usual field crops in pots, protected the surface of the soil from evaporation so that all the loss of water proceeded through the plant, weighed the water that was supplied from time to time, and finally weighed the produce, expressing their results as a ratio between the dry matter produced and the water transpired by the plant. These experiments have been repeated under different climatic conditions by Hellriegel in Heidelberg, by Wollny in Vienna, by King and others in America. Now the two processes in the plant, carbon assimilation and transpiration, are not causally connected, though, as both are carried out in the leaf and have some factors in common, they are found to show some constancy in their relative magnitudes. Lawes and Gilbert obtained a ratio of about 300 lb. of water transpired for each pound of dry matter harvested, but the other investigators under more arid conditions found much higher figures, up to 500, and even 700 to 1. Now, a crop yielding 20 bushels of wheat per acre will contain about a ton of dry matter per acre, so that, taking the high ratio of 500 to 1 no more than 500 tons of water per acre or 5 in. of rain will have been consumed in the production of this crop.

It is, of course, impossible to ensure that all the rain falling within a year shall be saved for the crop; much must evaporate before it reaches the subsoil where it can be stored, and only when the crop is in full possession of the land can we expect that all the water leaving the soil shall go through the crop. What proportion the waste bears to that which is utilised will depend not only on the degree of cultivation, but upon the season at which the fall occurs; summer showers, for example, that do not penetrate more than a few inches below the surface will be dissipated without any useful effect. When the climatic conditions result in precipitation during the winter, the water will be in the main available for crop-production; and it has been found by experience that cereals can be profitably grown with as small a rainfall as 12 in. The necessary cultural operations consist in producing such a rough surface as will ensure the water getting into the subsoil; hence autumn ploughing is desirable. Where the precipitation is largely in the form of snow, a broken surface also helps both to absorb the thawing snow and to prevent it being swept into the gullies and hollow places by the wind. On some of the Russian steppes it has become customary to leave a long stubble in order to entangle as much snow as possible, but probably a rough ploughing before the snowfall would be even more effective. When the rainfall drops to the region of 12 to 16 in., and occurs during the summer months, then dry-farming methods and the summer fallow become of the first importance. The deep cultivation ensures that the water gets quickly down to the subsoil away from danger of evaporation, and the immediate renewal of a loose surface tilth is essential in order to conserve what has thus been gained.

In connection with this dry-farming there are several matters that still require investigation before we can decide what is the minimum rainfall on which cultivation can be profitable. In the first place, we are only imperfectly informed as to the relation between rainfall and evaporation. At Rothamsted there are three drain-gauges side by side, the soil layers being 20, 40 and 60 inches deep respectively. The surface is kept rough and free from growth, though scarcely in the condition of looseness that could be described as a soil mulch. Yet the evaporation, even under a moist English atmosphere, amounts to one-half of the annual rainfall, and the significant thing is that the evaporation is approximately the same from all the gauges and is independent of the depth of subsoil within which water is stored. Evaporation then would seem to be determined by surface alone, but we are without systematic experiments to show how variations in the surface induced by cultivation will alter the rate of evaporation. A knowledge of the evaporation factor would then inform us of what proportion of the rainfall reaches the subsoil; we then want to know to what extent it can be recovered, and how far it may sink beyond the reach of the crop. It is commonly supposed that the subsoil below the actual range of the roots of the crop may still return water by capillarity to the higher levels that are being depleted, the deeper subsoil thus acting as a kind of regulating reservoir absorbing rain in times of excess and returning it when the need arises. But some work of LEATHER'S in India and ALWAY'S on the great plains of North America throw doubt on this view, and would suggest that only the layer traversed by roots, say, down to a depth of 6 feet, can supply water to the crop; the water movements from the deeper layers due to capillarity being too slow to be of much effect in the maintenance of the plant. The evidence on either side is far from being conclusive, and more experiment is very desirable.

It would also be valuable to know how far evaporation from the bare soil can be checked by suitable screens or hedges that will break the sweep of the wind across the land. In England hedges have always been looked at from the point of view of shelter from stock; we find them most

developed in the grazing districts of the west, while bare, open fields prevail in the east and south. Yet the enormous value of a wind-screen to vegetation can be readily observed, and the market gardeners both in England, and the still dryer districts of the south of France make great use of them. Lastly, we must have more knowledge about the relation between transpiration-water and growth; we do not know if the high ratios we have spoken of hold for all plants. Xerophytic plants are supposed to be possessed of protective devices to reduce loss of water. Are they merely effective in preserving the plant from destruction during the fierce isolation and drying it receives? and do they enable a plant to make more growth on a given amount of water? Wheat, for example, puts on its glaucous, waxy bloom under dry conditions. Is this really accompanied by a lower rate of transpiration per unit surface of leaf? and is it more than defensive, connoting a better utilisation of the water the plant evaporates?

The cultivation of these soils with a minimum rainfall necessitates varieties of plants making a large ratio of dry matter to water transpired, and also with a high ratio between the useful and non-useful parts of the plant. MR. BEAVEN has shown that the difference in the yields of various barleys under similar conditions in England are due to differences in their migration factors: the same amount of dry matter is produced by all, but some will convert 50 per cent. and others only 45 per cent. into grain. This migration ratio, as may be seen by the relation between corn and straw on the plots at Rothamsted, is greatly affected by season; nevertheless, MR. BEAVEN'S work indicates that under parallel conditions it is a congenital characteristic of the variety, and therefore one that can be raised by the efforts of the plant-breeder. The needs of dry-land farming call for special attention on the part of the breeder to these two ratios of transpiration and migration.—ADDRESS TO THE BRITISH ASSOCIATION.

BASTARD TRENCHING.

In connection with experiments that have been made in planting trees in holes in which the subsoil had been fractured by dynamite the following from the *Gardeners' Chronicle* is not without interest:—

The operation known as bastard trenching, the essential of which is the "breaking up of the bottom spit," has formed recently the subject of experiments by MESSRS. PICKERING and RUSSELL. The land treated was of four distinct types—light sand, two rather heavy loams, and a strong clay, and many of the experiments extended over four seasons. The land after bastard trenching was planted with dwarf fruit trees, and the results of the operations were compared with those obtained with trees in similar but untrenched ground. The results showed a surprisingly small benefit accruing from the operation. It was found that the trees in the trenched ground showed at little if any advantage over those growing in the untreated plots; physico-chemical examination of the soil indicated also but small amelioration, either with respect to moisture or nitrate content, and the authors conclude that, except where the soil has a hard pan, bastard trenching—provided that no manure is incorporated with the bottom spit—is productive of little benefit to the growth of the trees.

It must be conceded that the results are surprising, for since the days of JETHRO TULL we have been taught to attach great importance to the thorough working of the soil; at the same time we are inclined to think that if the experiment were repeated with quick-growing plants—vegetables or flowers—a more striking difference in favour of trenching would be observed. Although the experiments, as might be anticipated were made and are described with

are, we do not find mention of the extent to which the soil of the untrenched plots was disturbed during the planting of the trees. If the disturbance was considerable and affected more than the two top spits, the soil of the "untreated" plots was in fact and in some measure bastard trenched. In any case the moral to the gardener is apparent: supplement bastard trenching with the time-honoured practice of incorporating manure and other humus yielding materials with the broken-up spit, and whenever possible add to the manure a little phosphatic artificial manure, such as basic slag.

THE MEXICAN PROCESS OF CURING VANILLA.

The sun process is used in Mexico entirely. It requires the most time and labour and, as practised there, is really an art, if art, as has been said, is "simply an intense and intelligent application to detail." The vine flowers there during the months of April and May and the first beans are picked about the beginning of November, the picking continuing until the end of February. The green beans are first placed in long, ordinary rows on clean straw mats in the sun, where they are left for about an hour, in which time the tropical sun has caused them to attain considerable heat. They are then hurriedly taken up and put in large cases called "cajons," each capable of holding from two to four thousand pounds of beans. These "cajons" are well lined with blankets and when filled are covered with more blankets to make them as air-tight as possible and in this manner the beans are sweated for from twenty-four to forty-eight hours. They are still hot when taken out and placed on long frames or beds called "camillas" and taken into the "vainnillol," as the house is called, where the vanilla is stored. Here the "camillas" are placed in racks. In the "vainnillol" a good circulation of air is always maintained and the "camillas" are left here to dry and cool for several days, when the same process is repeated with the exception of length of time vanilla is sweated in the "cajon," which is shortened with each repetition.

This is done several times before the beans develop an aroma and many times before they are properly cured. About the beginning of March, those picked during November, having practically reached a state of perfection, are placed in a large tin-lined depository for observation as to the further development of flavour and keeping properties, for it must be remembered that if they are undercured the beans will deteriorate very rapidly, becoming mouldy or infected with a species of small vegetable lice which ruin the flavour, while if overcured some of the valuable flavouring properties are lost, the beans become dry and woody with a diminished aroma.

Those picked later are added from time to time, as they arrive at the same stage, so that by the middle of May the curing process is almost completed. During the time the beans remain in depository, they may, if necessary, be taken out and again put through the process of sunning, sweating and airing, though for a much shorter period than before.

They then pass a final inspection as to flavour, appearance and touch. If this is satisfactory they are ready for bundling and are taken from the depository, graded and sorted according to quality and length and put into bundles of about one hundred beans each.

GRADING, SORTING AND BUNDLING CURED BEANS.

If curing is an art bundling is indeed so, and in this respect the Mexican vanillero has no equal. The bundles average in weight about a pound and are packed in cans, forty bundles to each can, and the cans in turn are packed in cedar cases, four or five cans to the case. They are now ready for market.

Six months have elapsed since the vanilla was taken from the vine and during this period every bean has been handled individually many times. When cured it is about one-sixth of its original size in weight and circumference, though retaining its original length, and ranges in colour from a light reddish brown to a deep chocolate. Vanilla is graded by the Mexicans into six classes : "Picadura" or cuts, "Ordinario," "Mediana" or fair, "Buena" or good, superior or good to prime and extra or strictly prime.

Most of the vanilla gathered during November does not contain the same percentage of gums, resins and other flavouring properties that the later gatherings contain, consequently the beans must be cured down more, in order to develop their flavour and keeping properties ; and to facilitate this they are cut up in small pieces. These are the "Picadura" or cuts which form about 25 per cent. of the crop.

The vanilla next gathered constitutes, when cured, the ordinary quality and the beans are light reddish brown in colour ; after which come the "Mediana," which are somewhat darker. As the season advances the quality keeps improving, the superior and extra qualities, those richest in essentials and darkest in colour, being gathered from Christmas until the crop is completed.

There are times during the curing season when a long spell of inclement weather compels the curers to resort to the use of "Calorificas" or ovens, to generate the heat in place of the sun ; but as this rarely happens, that method is seldom resorted to.—INDIAN AGRICULTURIST.

CEYLON AGRICULTURAL SOCIETY.

PROGRESS REPORT, LXV.

MEMBERSHIP

The following members joined since the last meeting held on August 11th:—

E. Peace ; The Superintendent, Ferham Estate ; W. S. Cookson ; The New York Public Library ; John Booth ; F. W. Barker ; T. H. Obeyesekere ; Dr. M. J. de Jong ; Dr. M. J. Appaswamy ; W. Diopenheim ; Bulatgey Konnehamy ; Henry A. Peiris ; P. M Tikiriduraya ; T. B Madawela ; M. B. Ratwatte ; F. VanRooyen ; T. B. Panabokke.

This brings the total membership up to 1838.

STAFF.

The Secretary visited the following places in the course of his tours:—

Akurana, Alawatugoda, Palapatwela, Madawela, Naula, Panampitiya, Dambulla, Innamaluwa, Habarana, Mineri, Topawewa, Teldeniya, Urugala, Alutnuwara, Mediwaka, Kengella, Panadure, Bandaragama, Biyanwela, Pasyala, Danowita, Ambepusse, Kegalle, Kadugannawa, Talatuoya, Hanguranketa, Munwatte, Alutgama, Ittapana, Halwela, Matugama, Kalutara, Tantirimulla, Jambureliya, Kesbewe, Keenadeniya, Rattota, Pussella, Panwila, Etiyawala, Wekada, Makandura, Pannala, Naranmulla, Magama, Galle, Akuressa, Parakaduwa, Dampella, Telijjawila, Matara, Dikwella, Gandara, Nakulugama, Tangalle, Ranna, Kiula, Ambalantota, and Hambantota.

In addition to their usual circuits the Agricultural Instructors were on special duty during part of October and November in connection with the distribution of seeds among village cultivators.

Mr. K. Chinnaswamipillai was transferred to Anuradhapura in September on his appointment as Foreman of the Dry Zone Experiment Station there. His place at Batticaloa is being temporarily filled by Mr. S. S. Mapanar.

GARDENS.

Some of the trees in Bandaragama orchard have begun to bear fruit. The garden has been interplanted with *Tephrosia candida* with a view to improving the soil by green manuring.

The Balalla cotton station has been closed and a fruit garden is being established on the land attached to the Wariapola resthouse.

Cotton is being given another trial this season at Hettipola and Nikaweratiya, at the former place in rotation with grain, pulse and root crops.

The trees in Kegalle garden have been provided with labels bearing their botanical, common and native names.

A proposal to open an Experiment Garden in Batticaloa for the cultivation of South Indian crops is under consideration.

The gardens at Balangoda, Jaffna, Ambalantota, Badulla and Weragoda continue to make satisfactory progress.

PADDY.

The interval between this and the last meeting was the "off season" in paddy cultivation. The Yala crop of paddy had been taken in at the time the last report was presented and Maha cultivation commenced last month. During this interval sunnhemp experiments were conducted at the following centres:—Ratnapura, Matale, Nugawela (2 fields), Udispattu, Uduwela, Katugastota, Dunuwila, Tissa, Digawela, Tissawewa and Kekirawa. The sunnhemp when in flower presented a very striking appearance with its wealth of golden-yellow blossom. The effect of the green manure crop will not be discernible till early next year, and actual results will be available at harvest time.

Mr. L. de Z. Jayatilleke, Agricultural Instructor, furnishes results of a Manuring experiment conducted at Kosgoda:—1 acre of paddy was manured with 3 cwt. of the following mixture:—Bonemeal, castorcake and sulphate of potash. Plants were raised from 4 measures of seed and single seedlings transplanted 6 inches apart. The yield of the field was 27 bushels against 18 per acre from the adjoining unmanured field.

Mr. Jas. R. Nugawela, Agricultural Instructor, is conducting experiments to ascertain the relative merits of transplanting 1, 2, 3, 4 & 5 seedlings 9 inches apart in Harispattu

As the result of a proposal made by the Secretary of the Planters' Association, "Vadan-samba" paddy obtained from South India is being cultivated under tank irrigation by the Agricultural Instructor, N.C.P., and at the Dry Zone Experiment Station.

There has been a demand for Molagu samba paddy which did so well last year in the Chilaw district, and a fresh stock of seed was obtained from India. This is a 5 month variety and is well worth cultivating in districts where paddy of this age is grown.

Dr. Lock's selected *hathiel* paddy is being cultivated this season in Uduwela and Alapalawela on a more extensive scale than last year. Seed selection will be carried on as before.

Mr. P. B. M. Bandaranayake, Agricultural Instructor, Badulla, who carried out a transplanting experiment with single seedlings at Bindunuwewa reports that the yield per acre was 85 bushels against 40-60 bushels when broadcasted. Mr K. B. Beddewela in co-operation with Mr. Nugawela, Agricultural Instructor, is cultivating $2\frac{1}{2}$ acres with Muttusamba paddy on the transplanting system.

The use of white castor cake in manuring paddy has been so favourably reported on in South India, that Mr. W. Molegode, Agricultural Instructor, assisted by Mr. M. B. Halangoda of Wattegama, was induced to give it a trial. An acre of land—in an extensive range of fields—has been manured with 600 pounds and the cultivators are showing a keen interest in the experiment.

COTTON.

Owing to unforeseen difficulties having arisen in the relations with the local Agents of the British Cotton Growing Association and the absence of good seed, the cultivation of cotton on chena lands in the Hambantota district (which gave satisfactory results last year) had to be abandoned. The proposal to permit the cultivators who had their land ready for sowing, to raise quick-growing crops, such as Sorghum, during the present season has been approved by the Assistant Government Agent, and submitted for the sanction of Government.

The small consignment of Cambodia (a variety of American Upland) which is extensively grown in India, was received in good time for trials in Hambantota District.

PLANTAIN CULTIVATION.

In view of the contraction of plantain cultivation as the result of disease in certain localities, members may be glad to know that suckers from an uninfected area are available at the following rates:—Kolikuttu, Ash plantain, Etamuru, Diyamondan, Embul hondrawala, Suwandel and Puwalu at Rs. 70/- per 1,000; Alu-mondan and Sura mondan at Rs. 15/- per 100. The quotations are F. O. R., Rambukkana.

A Kegalle planter has furnished some interesting figures re plantain cultivation which have been communiciated to the TROPICAL AGRICULTURIST and appear in the November issue.

CASSAVA.

At a recent meeting of the St. Vincent Agricultural Society, correspondence with England and Canada was submitted which indicated that there was "an unlimited demand for dried cassava chips at remunerative prices," and it was resolved, with a view to introducing the new industry of cassava chips and in order to induce the peasants to grow the same to their advantage and indirectly to the benefit of the Colony, Government be asked to approve of a scheme for the purchase of the product on the same lines as is done with cotton.

The Secretary is in consultation with the Director of the Imperial Institute on the subject, so that if the price offered for cassava chips is sufficiently encouraging to warrant an extension of cassava cultivation (which is already fairly large) in the Island, the Society may be in a position to bring the producer and purchaser together.

ENCOURAGING THE CULTIVATION OF QUICK-GROWING CROPS.

The free distribution of seed in anticipation of any possible shortage of food supply in the villages during the present crisis was a heavy tax upon the resources of the staff. The Finance Committee voted a sum of Rs. 1,000/- for this work.

The instructors assisted by four officers of the Agricultural Department visited select centres in each district with a view to ascertaining the requirements of the different localities and forwarding requisitions for such seed as there was urgent need for. The actual distribution was done through accredited agents, chiefly schoolmasters and headmen. Surplus local stocks of seed from specific areas were drawn upon, and this supply was supplemented by consignments from India and Australia. A large quantity of Dhura or Egyptian sorghum was procured from the Experiment Station, Peradeniya. The school gardens rendered material assistance in meeting the demand for special varieties of seed and cuttings. A difficulty that had to be faced was the general rush for seed, and it was necessary to discriminate carefully between *bona fide* village cultivators and others.

A number of applications were also received from Estate Superintendents on behalf of their coolies; and it may be presumed that all localities which were found to be actually in need of seed have been supplied. This free

distribution while giving an impetus to dry (and mostly waste) land cultivation should ensure a plentiful stock of seed for the coming season. During a recent visit to the Matara district the timely action taken by the people particularly in the Weligam Korale where very little idle land is to be seen, was quite apparent.

The Secretary desires to place on record the valuable services rendered by Mr. W. Molegode, who ably assisted him in the trying task both of securing supplies and meeting demands.

Till the work was organized and brought to a system it was necessary to draw on all available sources for help, and this was readily forthcoming. Extra hands for packing were kindly lent by the Director of Agriculture, while the services of the Foreman of the Government Stock Garden and the Chief Clerk (Mr. C. D. W. Kanangara) of the Division of Lowcountry Products and School Gardens as well as the four Burmese students under training in School Garden methods, were also requisitioned.

The following summary will indicate the nature of the work done between October 25th and November 15th:—

The number of applicants totalled 402, while 13,321 packets of seed, 6,100 cassava cuttings, 6 cwt. sweet potato cuttings, 6 maunds of potatoes, 200 lb. yams and 600 lb. dhura were distributed among applicants in 340 centres.

Of seeds the following varieties were supplied:—

Bean	...	...	1546
Cow Pea	...	...	1199
Gourd	...	...	1350
Luffa	...	...	473
Pumpkin	...	...	833
Cucumber and Melon		...	946
Chili	...	...	946
Maize	...	...	664
Radish, Carrot, Beet and Knol Kohl			612
Brinjal	...	...	502
Cabbage and Lettuce		...	447
Tomato	...	...	235
Bandakka	...	...	767
Miscellaneous	...	...	3694

CATTLE BREEDING.

The pedigree Kangayam Bull belonging to the Society, after being stationed at Jaffna under the care of Mr. S. Chelliah, Agricultural Instructor, was transferred to Hambantota in September by arrangement with the Assistant Government Agent. The animal is now stationed at Walawe not far from the Ambalantota Experimental Garden, and is in direct charge of the Mudaliyar of Magam Pattu who applied for its services.

I inspected the arrangements for its upkeep early this month and found them satisfactory.

RECLAIMING ALKALINE LANDS.

The following report of an Indian experiment should be of interest to those who own land on which the soil is of alkaline character:—A piece of wet land (0·20 acre) was sown with one Madras measure (3 lb.) of dhaincha (*Sesbania aculeata*) during the first week of March, 1913, when the paddy had been harvested, after one ploughing with the moisture available. A second cross ploughing was done in order to cover the seed. The plants branched profusely and grew to a height of 10 feet in a little over 6 months. The plot became flooded with stagnant water during the season, that is, at the beginning of the latter half of September; and after four days, the stems became shaky and were pulled out. In the meanwhile a good quantity of leaves had been shed on the ground and the few leaves that remained were stripped off and strewn over the field. The stems with their roots and branches were sold for fuel after collecting the seed of which 30 Madras measures (90 lb.) were

obtained. In addition, 4 cartloads of finely decomposed stable-refuse were applied. Trimming bunds and corners and ploughing in puddle 4 times over followed. The result was the complete removal of alkalinity in the soil, and the increase of the outturn of paddy from 75 lb. in the previous year to 450 lb. The physical character of the soil was considerably improved as the roots of dhaincha were found to have gone down to a depth of a foot and a half, thereby rendering drainage more free, the chief desideratum in all clayey alkaline lands.

Mr. S. Supramaniam of Pt. Pedro has been supplied with a quantity of seed for a trial which he is carrying out on a field in Karaveddy West.

LAC.

Mr. K. B. Beddewela reports that of the lac removed from *Zizyphus jujuba* trees 7½ lb. were supplied to the Hony. Secretary, Kandyan Art Association and about ¾ lb. to a Chemist for making shellac, while a quantity of brood lac was sent to the Hon'ble Mr. T. B. L. Moonemale, Messrs. N. J. Campbell, P. B. Godamune and J. R. Nugawela.

The dye obtained from the washings of the lac was sent to Mr. U. B. Dolapihilla of the Hewavitarne Weaving School, who is experimenting with it in dyeing cloth.

The masan *(Zizyphus jujuba)* has proved to be the best host plant; next comes the Kon *(Schleichera trijuga)*. On the rain tree *(Pithecolobium saman)* lac was slow in developing, so also with Keppitiya *(Croton lacciferus)*. On karanda *(Pongamia glabra)* lac developed fairly well.

Arrangements have been made to inoculate Masan *(Zizyphus jujuba)* trees at the Government Stock Garden and on Mr. J. C. Ratwatte's Mahayaya property. The cultivation will be continued on Maligatenne Estate.

VISIT TO THE EXPERIMENT STATION, PERADENIYA.

On the 17th of September the Director of Agriculture summoned a meeting of Agricultural Instructors with a view to discussing ways and means for ascertaining the requirements of village cultivators in respect of seeds, etc. in order to supplement the season's cultivation with the raising of quick-growing dry-land crops so that additional sources of food supply may be available to meet any increased demand caused either by a shortage of imported food stuffs or by an increase of the unemployed in villages.

Following upon this conference the Instructors made a tour of the Experiment Station accompanied by the Director, the Secretary, Ceylon Agricultural Society, the Superintendent of Botanic Gardens and the Manager of the Station, who conducted the party over the Estate and furnished all the necessary information regarding the various experimental plots. The tour was a most instructive one for the visitors who were also shown the working of the disc harrow. Among the annual crops under cultivation was Dhura or Egyptian Sorghum which, though not growing under ideal conditions as regards climate, made a striking show. The general impression left on the visitors was that very useful work was being done under Mr. Corlett's management.

POTATOES.

Cluster sweet potatoes introduced by the Society some years ago is now extensively grown in the Island. At Mediwake Experimental Garden ½ an acre was planted during the N. E. Monsoon and a crop of 2876 lb. of tubers obtained. For a second time ¼ acre of the same land was cultivated and a mid-year crop of 946 lb. gathered; or a total of 3822 for the year. Forty local cultivators secured cuttings from this plot, and a hundredweight of cuttings was supplied to applicants in other parts of the Island.

In view of the successful trial of *potato cultivation* in North Dumbara arrangements were made for another trial this season. As it was impossible to get seed potatoes locally, a maund of each of the following acclimatised

varieties were obtained from the Superintendent of Ootacamund Botanic Gardens in good time for putting down:—

1 Maund Potato Brownell's Beauty
1 ,, ,, Up-to-date
1 ,, ,, Imperator
1 ,, ,, Ninety-fold
1 ,, ,, Cambridge Kidney
1 ,, ,, School Master

MISCELLANEOUS.

Mr. D. S. Corlett, Manager, Experiment Station, Peradeniya, has furnished the following information regarding the *disc harrow* used on the Experiment Station:—The harrow is a No. 8 Massey-Harris and has 14 discs. It could be effectively employed on unploughed land only if the soil is light and sandy and carrying but small weeds. If heavy or hard and covered with grass and mimosa, the plough must be used first and the land thoroughly cleaned of weeds and roots. This done, the harrow should be put on every 6 weeks or so, and will keep down weeds for years without reploughing. It is not advisable to use the harrow at frequent intervals on steep land as it would promote wash. A pair of bulls should do from 1 to 2 acres a day according to condition of land.

With the contraction of *cinnamon cultivation* in the Negombo district its adoption in areas unsuitable to better paying crops and where it is likely to do well, is to be encouraged. Mr. L. A. D. Silva, Agricultural Instructor, Balangoda, realising this fact, has established a small plantation at Mahawalatenne which gives much promise.

The imported *grape plants* distributed by the Society in the grape-growing villages of Jaffna peninsula and periodically inspected by the Instructor are reported to be doing well. The fruit of the Gordo Blanco variety produced at Bandarawela was of excellent quality and flavour.

The Society imported from Java a quantity of *Coffea robusta* for interplanting with rubber chiefly in the Southern and Sabaragamuwa Provinces.

A number of applications have also been received for *pineapple suckers*, and Father Stanislaus' experiment in pineapple-growing in Mannar will be watched with interest.

Specimens of *grape fruits* have been received from various quarters.

THE PRESENT CRISIS.

The agricultural outlook, in common with that for all trades and industries, has been clouded by the political complications in Europe with their deplorable results: and yet this colony has good reason for gratulation in that it has escaped any severe shock. At the same time, in view of the need for rigid economy in all directions, it behoves the agriculturist, whether he has to deal with extensive estates or small fields and gardens to put into practice that cardinal precept of agriculture which aims at securing the largest produce at the smallest cost and with the least deterioration of the land. This important principle has not, it is to be feared, been realised to its full extent in a country where Nature is so bounteous. But the present crisis, which has forced so may lessons upon us, demands harder and more thorough work and greater vigilance and foresight on the part of all concerned with the cultivation of crops.

Our local organizations—the Department of Agriculture, the Ceylon Planters' Association, the Lowcountry Products Association, as well as this Society—are doing all in their power to minimise the effects of the war on our rural economy and are thus assisting, albeit in a humble way, to safeguard the common weal of the Great Empire to which we belong.

C. DRIEBERG,
Secretary.

24th November, 1914.

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